# THE STUDENT'S
# COURSE IN PHARMACY.

THE

# Student's Course in Pharmacy,

A SERIES OF LECTURES

FOR THE USE OF DRUG CLERKS AND HOME STUDENTS

IN

# PHARMACY.

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NASHVILLE, TENN.:
FRANC. M. PAUL, PUBLISHER.
1890.

# PREFACE.

In preparing the following lectures it is the intention to present, within a limited space, such information as will be of practical use, and with this end in view I shall draw freely upon the most distinguished authors and dictionaries of such sciences as pertain to pharmacy. No pains will be spared to make these lectures as comprehensive and complete in their character as possible. Care will be taken to avoid, wherever practicable, the use of difficult technical terms, and to so simplify the language that the reader may escape embarrassment by expressions unfamiliar to those ordinarily acquainted with the science.

Each lecture should be mastered before the corresponding questions are answered, and no reference be made to the lectures for answers. A strict adherence to this rule will greatly inure to the advantage of the student, both because of the closer study required and because such independence will inevitably add to the student's knowledge. It is believed that compliance with the above suggestions will facilitate study and assure the attainment of the utmost information of practical and permanent value.

The lectures are presented in the confident hope that they may prove, as intended, of practical utility to the pharmaceutical student.

W. H. Watson.

—THE—

# Student's Course in Pharmacy.

## PHARMACY.

### Lecture I.

By the term pharmacy we understand that branch of knowledge which includes those sciences and arts necessary to the proper compounding and preparation of drugs and medicines. It follows, therefore, that we have two branches of pharmacy—theoretical pharmacy and practical pharmacy.

The study of theoretical pharmacy embraces a wide range, since the animal, the vegetable and the mineral kingdoms all contribute something to pharmacy as drugs and medicines.

Practical pharmacy is the practical application of the knowledge obtained in the study of theoretical pharmacy.

We will hereafter refer more fully to the different sciences which may be denominated as the handmaids of pharmacy.

Zoology, physical laws, etc., will come under our notice. A thorough acquaintance with these is not necessary to the pharmacist, but a limited knowledge, that is a knowledge of those parts essential to pharmacy, is absolutely requisite.

Civilized nations have established standards for the guidance of all as to the purity, uniformity and strength of drugs and medicines. These works, containing also a standard list of formulas and substances used in medicine, are known as PHARMACOPŒIAS. Other nations than ours have seen fit to give to their pharmacopœias the stamp of legality. In the United States, however, the pharmacopœia, although not legalized by enactment, is authorized by the "National Convention for Revising the Pharmacopœia," held at Washington in 1880, consisting of members appointed from the various societies and colleges of pharmacy of the United States, and is received by druggists as the only authorized standard. It occupies in point of scientific arrangement, completeness and accuracy a place "second only to that of the Pharmacopœia Germanica" (German). Its nomenclature becomes of interest to the student, since it gives the officinal name—always Latin—of the drug, also its English name, its synonyms, and in cases of plants or chemicals, the botanical names and the symbolic formulas.

A Dispensatory is a "commentary on a pharmacopœia," and contains information as to unofficinal as well as officinal drugs; also as to those which are rarely or only occasionally used. It gives the description, constituents, medical uses, dose, etc., of the various drugs it describes.

## SPECIFIC GRAVITY.

The specific weight of a body is its weight compared with that of another of equal bulk. Water is the standard of comparison, bodies being considered as lighter or heavier than water. In warm weather bodies generally undergo an expansion of volume, and in cold weather a contraction of volume, and become specifically heavier when cold and lighter under the influence of heat; consequently the specific gravity of a body is the weight of similar volumes at a temperature of sixty degrees Fahrenheit, 60° F. being the standard as to temperature at which comparisons should be made. This insures unity of comparison.

The knowledge of specific gravity is of benefit to the pharmacist, since it may enable him to identify a drug or judge of its purity.

A body immersed in water loses as much in weight as the weight of that liquid is that is displaced by it.

In determining the specific gravity of bodies heavier than water, first weigh the body, then weigh it submerged in water, then divide its weight in the air by the loss it has sustained while weighing it in the water; the quotient will be the specific gravity.

*Example*—A substance weighs in the air 250 grs., and submerged in distilled water it weighs 200 grs.; loss 50 grs.—$250 \div 50 = 5$—hence the specific gravity of the substance is 5.

To determine the specific gravity of bodies lighter than water, attach to the body some substance sufficiently heavy to immerse it, whose weight in air and water is known, weigh them together both in air and water and note the loss in weight. Subtract the loss of the heavy body weighed alone in water, previously known, from the loss sustained by the combined solids; the remainder will be the weight of a bulk of water equal in bulk to the lighter body; divide the weight of the lighter body in air by this remainder and the result will be the specific gravity required.

*Example*—Suppose the lighter body weighs 3 ounces and the heavier 15 ounces, and the two together immersed in water lose 5 ounces, and suppose the weight which the heavier body loses when submerged alone be 1 ounce; subtract the loss of weight sustained by the heavier body while immersed, 1 ounce, from the loss sustained by the two in water, 5 ounces, we have 4 ounces as the weight of a mass of water equal in bulk to the lighter of the two bodies. But the lighter body in the air weighs 3 ounces; hence the specific gravity is $3 \div 4 = \frac{3}{4} = 0.75$. It therefore weighs $\frac{3}{4}$ of its own volume of water and has a specific gravity of 0.75.

To obtain the specific gravity of bodies soluble in water, select some liquid in which the substance is

insoluble, then divide the weight in the air by the weight lost in this liquid and multiply the result by the specific gravity of the liquid.

*Example*—A piece of sulphate of copper weighs 150 grs. in air, in oil of turpentine it weighs 93 grs.; loss 57 grs. Original weight, 150 grs., divided by 57 grs. equals 2.63; multiplied by 88, specific gravity of turpentine, equals 2.3144, the specific gravity of the sulphate of copper.

The specific gravity of insoluble powders is easily obtainable by means of a specific gravity bottle, a description of which may be found in any work on pharmacy. In experiments, however, care must be taken as to the purity of the water, its freedom from air bubbles, etc.

In obtaining the specific gravity of gases, air was formerly used, but hydrogen is now regarded as the standard of comparison. The weight of a given volume or measure of the gas is compared with an equal volume of hydrogen gas and the weight of the gas divided by the weight of the hydrogen; the result is the specific gravity of the gas.

## SPECIFIC VOLUME.

Specific volume has been defined by all leading writers as directly opposed to specific gravity—the opposite of specific gravity. To obtain the specific volume of a liquid the rule is—"Divide the volume of the given weight of the liquid by the volume of an equal weight

of water, or divide the specific gravity of water (1.000) by the specific gravity of the liquid."—(Remington).

If we know the weight of a certain liquid, in order to obtain its volume, "multiply the volume of an equal weight of water by the specific volume of the liquid."

### THERMOMETERS.

The thermometer is an instrument that is often used in the practice of pharmacy. The expansion or contraction of a body under the influence of heat or cold is expressed in degrees, hence we have the thermometer, an instrument that enables us to ascertain the degree of sensible heat a body is able to impart. Mercury, because of its regular expansion, is used, and being placed in a graduated glass tube rises and falls according to the heat or cold to which it is subjected. A vacuum is first obtained in the tube, and then melting ice and boiling water being mediums of an invariable temperature, it is subject to their influence, and the tube is then marked at the highest point at which it rises and at the lowest to which it falls while under their influence. When this is done the intervening space is marked off into degrees. Alcoholic thermometers, etc., are also used. Fahrenheit's thermometer is the one in general use in this country. There are, however, three thermometers in use, the Fahrenheit, Celsi or Centigrade, and the Reaumur. On the Centigrade and Reaumur thermometers the freezing point is placed at zero, while the boiling point of water on the Reaumur thermometer.

however, is placed at 80°, and on the Centigrade at 100° above zero. On the Fahrenheit thermometer the freezing point of water is placed at 32° above zero, and the boiling point at 212° above, the number of degrees between the two standard points being 180 instead of 80, as in Reaumur, and 100, as in the Centigrade. The centesimal scale of the Centigrade being more in harmony with the metric systems of weights and measures is coming more into use, especially in works of a scientific character. There being thus three different thermometers in use, it becomes necessary sometimes to convert the degrees of one scale into those of another. In order to convert Fahrenheit to Celsi or Reaumur, always first subtract the 32 degrees.

*Example*—To reduce Fahrenheit to Celsi first subtract 32, then multiply by 5 and divide by 9. To convert Celsi to Fahrenheit, multiply by 9, divide by 5 and add 32. We give below some remarks on this subject copied from a late article in THE DRUGMAN written by J. C. Wharton, Professor Pharmacy Vanderbilt University, which will give the student further light on this subject:

In the conversion of degrees Fahrenheit into their equivalents of the Centigrade thermometer, there is frequently a confusion in the mind as to the order in which the steps toward solution of the arithmetical problem occur, the difficulty most common being with reference to the number 32, which is sometimes added first and at other times last, and again it may be required to subtract 32 first or last. These variations in the

manner of using this number arise from the four conditions possible, namely: degrees above zero; degrees below zero; Fahrenheit to Centigrade; Centigrade to Fahrenheit. By using the proper arithmetical signs in connection with the numbers, making degrees above zero as plus (+) and below zero minus (—), confusion is less likely to occur. The method or steps to reduce degrees F. to C. would be expressed as follows:

F. $(\pm a°) - 32 \times 5 \div 9 = (°)$C., or:

F. to C.: $-32 \times 5 \div 9$.

That is, apply to Fahrenheit degrees the numbers as indicated, consecutively, and the result will be Centigrade degrees. To reduce C. to F., *reverse all the steps and all the signs, thus:*

C. to F.: $\times 9 \div 5 + 32$.

The numbers may be arranged as follows for a more ready comprehension:

| | |
|---|---|
| F. (?°) | C. (?°) |
| — 32 | × 9 |
| × 5 | ÷ 5 |
| ÷ 9 | + 32 |
| C. (?°) | F. (?°) |

## WEIGHTS AND MEASURES.

The weight of a body is a measure of the force with which it is attracted to the center of the earth, as all bodies are attracted toward this common center, and all bodies press downward with a force proportioned to the degree of this attraction. In ordinary language, it is "the quantity of matter contained in a body as ascertained by the balance."

Weight being a measure of the earth's attraction, it follows that bodies will weigh the most when nearest the center of the attraction, consequently a body at the poles, which are flattened and nearest the center of the earth, will weigh more than one at the equator, which point is farthest from the center.

A body weighing one thousand pounds in the city of New York at the level of the sea would gain three pounds if carried to the north pole, and would lose about four pounds if carried to the equator under the same conditions.

A body at the center of the earth would lose all weight, since being surrounded on all sides by an equal mass of matter it would be equally attracted in all directions. Therefore, by weighing a body we may estimate the quantity of matter it contains. In weighing very light bodies it is also necessary sometimes to take into consideration the bouyant effect of the atmosphere, since the air has a tendency to buoy bodies and render them lighter or heavier. It is necessary also sometimes that temperature be considered in the weighing of bodies, since bodies contract under the influence of cold and expand under the influence of heat.

In all the operations of trade and commerce we exchange a certain given quantity of one article or substance for a certain quantity of some other article or substance—so much flour for so much sugar, so much flour for so much gold. This being true, it follows that it is necessary that we have some fixed rules or standards

according to which different quantities of different substances may be compared. A set or series of such rules or standards of comparison is called a system of weights and measures. Different nations adopt different standards, but in the civilized world two great systems of weights and measures are recognized. These are the French and the English systems. The English system is the one used in the United States.

The construction of the balance or scale is so well known and so simple that a description of it here is unnecessary. The more sensitive a balance, as in case of prescription balances, the more delicate its construction, consequently one should be very careful with his prescription balance, since he must use it for weighing the minutest substances, as well as the most dangerous to life. It should always be kept clean and be kept in a glass case to avoid the dust and to protect it from the corrosive effect of acid fumes, etc., which injure its sensitiveness and accuracy by attacking the steel knife edges. After using the pans should always be allowed to rest, and if no fixture accompanies the balance for that purpose place one pan on top of the other till needed for use. The weights must be kept clean and bright in order to be reliable, and should be preserved in a box or drawer to avoid the dust and the corrosive action of chemicals. A cheaper grade of scales is used for the other purposes of the store.

In the English system in use in this country there are two kinds of weights, Troy and Avoirdupois weights.

Previously to 1880 Troy weights were recognized as the official standard by the United States Pharmacopœia.

The smallest weight made use of in the English system is a grain. By a law enacted in England in 1286 it was declared that thirty-two grains of wheat, taken from the middle of the ear and well dried, should weigh a penny weight, hence the name grain applied to this weight. Afterwards it was enacted that it should be divided into only twenty-four grains. Grain weights are made generally by weighing a thin plate of metal of uniform thickness and then cutting out by measurement such a part of the whole as should weigh one grain. Weights may thus be obtained that weigh only the one-thousandth part of a grain. The following summary of Troy weight shows the number of grains in each denomination:

| | |
|---|---|
| The scruple, . . . . . . . . . . | 20 grains. |
| The dram, . . . . . . . . . . . | 60 grains. |
| The ounce, . . . . . . . . . . . | 480 grains. |
| The pound, . . . . . . . . . . | 5,760 grains. |

Since a dram is equivalent to a teaspoonful, fluid measure can always be reduced to drams. Avoirdupois weight is the standard used in commercial dealings. The Avoirdupois pound contains 16 ounces and is equal to 7000 grains, while the Troy pound contains only 12 ounces.

While the Troy ounce is equal to 480 grains, the Avoirdupois ounce is only equal to 437½ grains, making a difference in favor of the Troy ounce of 42½ grains.

The abbreviations of the denominations are represented by the following signs:

| | |
|---|---|
| Ounce, | ℥. |
| Dram, | ʒ. |
| Scruple, | ℈. |
| Grain, | Gr. |

Care should be taken in writing these to avoid doing so in a rapid and careless manner, lest one be written for the other.

MEASURES.

A U. S. pint of distilled water at 60° Fahrenheit weighs 7291.1+ grains; the U. S. fluid ounce, 455.7 grains.

The abbreviations in liquid measure are represented by the following signs:

| | |
|---|---|
| Gallon. | Cong. |
| Pint. | O. |
| Fluid ounce, | Fl. ℥. |
| Fluid drams, | Fl. ʒ. |
| Minims, | M. |

The gallon is divided into 8 pints, one U. S. pint into 16 fluid ounces, one fluid ounce into 8 fluid drams, and one fluid dram into 60 minims.

In dispensing fluids graduated glass measures are used, and should always be of known accuracy.

Accurate results in the measurement of liquids can not be obtained by means of dropping them, as the size

of drops vary greatly, even with the same liquids, according to the conditions existing when the measurement is made. The quantity of liquid in the vessel, the size and shape of its lip, the rapidity of dropping, and the temperature of the liquid will each affect the size of the drops. A drop is not a minim, although they are sometimes confounded. Some liquids comparatively light give larger drops than those of greater density. Watery solutions, for instance, give 50 to 60 drops to one fluid dram, while chloroform, heavy and dense, gives from 200 to 300. Alcoholic liquids generally give small drops.

## THE METRIC SYSTEM.

The metric system originated in France, and there is no doubt that where scientific work is concerned it is far superior to both the Avoirdupois and Troy systems. It is used also to some extent in writing prescriptions.

By a close vote the committee on the revision of the United States Pharmacopœia of 1880 was directed to construct that work in conformity with the metric system by adopting decimal parts by weight throughout, with the exception of a single class of preparations. In 1884 a law was enacted by the United States Congress making the use of this system lawful, but not compulsory.

The metric system is based upon the meter, which is the standard unit of linear measurement, being equivalent to the ten-millionth part of one-fourth of the cir-

cumference of the earth through the poles. It is also equal to 39.37+ inches.

The litre is the standard of fluid measure, and is the cube of one-tenth of the meter.

A cubic centimeter is the cube of one-hundredth of the meter.

The unit of weight is the weight of one cubic centimeter of water at its maximum density, termed gramme or gram, and is equivalent to 15.432 grs.

All divisions of the metric system are divisible by 10. It is sometimes called the "decimal system."

Latin prefixes are used to designate quantities below one gram, and Greek prefixes to designate those above one gram, and so with other units of the system, as follows:

| | |
|---|---|
| 1.—Gram (abbrev. gm.), . . . . . . . | 15.432 grs. |
| .10—Decigram (abbrev. dcg. or dg.), . . | 1.543 grs. |
| .01—Centigram (abbrev. cntg. or cg.), . . | 0.154 grs. |
| .001—Milligram (abbrev. mg.), . . . . . | 0.015 grs. |

| | |
|---|---|
| 1.—Gram (abbrev. gm.), . . . . . . | 15.432 grs. |
| 10.—Dekagram (abbrev. dg.), . . . . . | 154.32 grs. |
| 100.—Hectogram (abbrev. hcg. or hecto.), | 1543.2 grs. |
| 1000.—Kilogram (abbrev. kg. or kilo.), . . . . . . . . . . . . . . | 2 lb. 3 oz. 120 grs. Av. |
| 10000.—Meyriagram (mg.), . . . . . | 22 lb. 320 grs. Av. |

## Questions to Lecture I.

Ques. 1. What is pharmacy?

Ques. 2. What is practical pharmacy?

Ques. 3. Is the United States Pharmacopœia legalized by enactment?

Ques. 4. What is a dispensatory?

Ques. 5. What is specific gravity or weight?

Ques. 6. What is specific volume?

Ques. 7. What thermometer is in general use in this country?

Ques. 8. What is the smallest weight made use of in the English system.

Ques. 9. Give the signs representing the abbreviations used in liquid measure?

Ques. 10. What prefixes are used to designate quantities below one gram, and what prefixes those above one gram, in the metric system?

# PHARMACY.

## Lecture II.

### HEAT.

It is of great importance to the pharmacist that he should have some understanding of the operations of heat and of the laws controlling them, since without its aid many pharmaceutical operations could not be accomplished.

We can, however, only give here a description of the more important features of our subject.

Heat is a physical agent, known only by its effects on matter. Formerly it was classed with "imponderable matter," but it is now known to be simply a mode of motion which is capable of producing in us the sensation of warmth.

The generally accepted theory as to the phenomenon of heat, and the one now believed to be correct, is known as the "dynamical theory," in which it is assumed that heat is produced by the constant vibration of the molecules composing the body.

A distinguished English chemist, by a series of experiments, finally came to the conclusion that he could see distinctly the *billionth* part of a grain—truly a

wonderfully small particle—yet small as this particle was, according to the atomic theory, it was formed of many other smaller particles known as molecules, these in turn being formed of several atoms united together.

An atom is such an ultimate portion of matter as is no longer separable into parts.

A molecule is formed of several atoms united together; for instance, a molecule of oxygen contains two atoms, while a molecule of barium contains four. A molecule may be destroyed but an atom is indestructible.

Every substance is supposed to be formed of these minute particles called molecules. They are not in absolute contact with each other, even in the most compact bodies.

The molecules of a body are supposed to be in a state of vibration, and it is this molecular vibration that gives rise to the phenomenon we call heat.

A body is said to be hot or cold, according to the degree of vibration present. If the vibration is rapid, the body is hot, and as the vibration grows slow, the body becomes cooler.

Those desiring further information on this subject can obtain it by consulting any recent work on physics.

The quantity of heat in, and its effect upon, a body is estimated only by the change in bulk or appearance it assumes according as heat is added or subtracted.

The temperature of a body is the degree of *sensible* heat it contains.

The greatest natural temperature of which we have an authentic record occurred at Bagdad (1819), when the thermometer (Fahrenheit's) rose to 120° in the shade.

About 70° (Fahrenheit) below zero is the lowest record made by any of the Arctic explorers; 220° F. below zero has, however, been produced artificially.

When we touch a body warmer than ourselves, a subtle, invisible stream flows from it to us, producing the sensation of warmth.

This subtle, invisible stream is called caloric. Caloric, therefore, is the *agent* which produces the sensation of warmth, but *heat is the sensation itself;* the distinction between the two should be carefully noted.

Cold is a relative term, expressing the absence of heat in a degree, not its total absence, as heat always exists in all substances, and possesses the distinguishing characteristic of passing through and existing in all kinds of matter at all times.

Ice is known to contain heat in large quantities. This was proved by Sir Humphrey Davy, who, in a room cooled below the freezing point, extracted heat from two pieces of ice by friction and quickly melted them.

Heat diffuses or spreads itself among all surrounding bodies until they all possess a uniform temperature.

If we were to balance a piece of ice in a scale and then allow it to melt we would discover no loss or increase in the weight; or if we were to balance a piece of red-hot iron in the scale and wait till it had perfectly

cooled we would find the equilibrium of the scale not disturbed in the slightest degree; hence the conclusion that heat is imponderable—possessing no perceptible weight.

The principal effects of heat may be defined as Expansion, Liquefaction, Vaporization and Ignition.

The most obvious effect of heat upon material substances is to expand them, or increase their dimensions.

The three states in which matter exists are (1) Solids; (2) Liquids; (3) Gases.

We may regard the particles of any body as being subject to two opposing forces—cohesion, which tends to hold them together, and heat, which tends to drive them apart.

In solids the cohesion is so much stronger than the molecular vibration that the particles are not easily displaced.

In liquids the two forces nearly balance each other, and the cohesion being weak, the molecules move upon each other with the greatest facility.

In gaseous bodies the molecules are not held together by any force of attraction, and have a tendency to expand indefinitely. So great is their tendency in this direction, that if confined they exert a pressure upon the walls of the containing vessel.

Such is the tendency of heat to drive the molecules of a body apart, that if it be increased to a certain temperature, the body becomes a liquid, and in the case of many substances, if the heat be still further in-

creased, the molecules are driven farther apart, until the cohesion is destroyed and the particles fly apart in the form of vapor. When, however, the influence of heat ceases, cohesion resumes its action on the particles and they again assume the liquid or the solid shape. Take water, for instance; heat driving the particles asunder changes solid ice into a liquid; increase it and it changes the liquid into steam—a vapor. Now, withdraw the heat and cohesion, bringing the particles closer together, changes the vapor into a liquid; withdraw the heat still farther, and cohesion changes the liquid form of the body to a solid state and we have the solid, ice.

The four principal sources of heat are (1) the Sun; (2) Electricity; (3) Chemical Action; and (4) Mechanical Action.

The most important source of heat, however, to the pharmacist, is that created by chemical energy and known as *combustion.*

The ordinary combustible materials are used. Coal gas, however, is said to be perhaps the best, as being "convenient, safe, cleanly, and heat of almost any required degree of intensity can be obtained by means of it.

Large quantities of heat are created also by mechanical action.

The heat created in the boring of a brass cannon was sufficient to heat two and a half gallons of water to the boiling point, although the shavings cut by the borer

weighed only a few ounces. In this and similar cases it appears that the motion is converted into heat.

There are three ways in which heat may be conveyed from one body to another.

1. By conduction.
2. By convection.
3. By radiation.

If one end of a bar of iron, to give a familiar explanation, be placed in the fire and allowed to remain, we will soon feel the heat at the other end. In this case the heat has traveled from the heated end, molecule by molecule, to the other end. This is called conduction.

Different substances conduct heat with different degrees of facility; the same is true of the same kinds of substances in different states.

If two similar rods, one of iron and one of glass, be held in the hand and their ends held in the flame of a lamp, the iron rod will soon become too hot to hold, while the glass rod will feel comparatively cool.

The metals are the best conductors of heat. Much difference exists between them though, as silver has a conducting power of one thousand, while tin has a conducting power of one hundred and forty-five, and bismuth one of only eighteen.

Stones, dense woods, etc., are next in order. and then follow the liquids.

The gases are the poorest of all conductors, as their conducting power is almost inappreciable; their mole-

cules being farther apart than those of liquids or solids communicate their motions less rapidly.

When heat is applied to the bottom of a vessel containing a liquid, the layer next to the bottom becoming heated, expands and rises to the next layer and does the same, until a complete circulation is set up and the liquid is heated in all its parts to the boiling point. This is called *convection*.

Gases may be heated in this way, and it is chiefly by this means that the air is heated by the rays of the sun.

Heat travels at the rate of 186,000 miles per second.

Heat is not dependent upon the air for transmission, as it can be readily transmitted where there is no air as rapidly as it can be where the air is present, since it travels uninterrupted through space.

Our atmospheric envelope, it has been calculated, reaches only some fifty miles above the surface of the earth, but the heat rays of the sun travel through the space beyond to the earth, thus demonstrating that the air is not the medium by which they are conveyed.

The hypothesis, however, has been advanced that the space existing between the heavenly bodies is filled with an elastic but exceedingly tenuous substance called ether, and that the heat propagated in waves from its original source by its molecular vibrations travels through the ether as a medium of conveyance, since some kind of matter must be the vehicle of a force. In this way heat is supposed to be propagated by means of the ether, much as sound is conveyed by means of the atmosphere.

## LATENT HEAT.

While a substance is melting its temperature ceases to rise, however much heat may be applied. This shows that much heat must disappear during the process. This heat is said to become latent. "Latent heat differs physically from free or sensible heat in that its presence can not be determined by the senses or by the thermometer."

When, however, a body is changed from a gaseous state to a liquid state, or from a liquid state to a solid state, the latent heat is evolved and its presence becomes sensible; the same is true also in certain cases of chemical action.

All bodies contain heat in varying quantities. This fact, although we can not detect it by our senses, may be demonstrated by experiment.

The temperature of ice is 32°, but if melted and changed into water the water will be fonnd to be no hotter than the ice was before, yet 140° of heat have disappeared in the melting. It has been absorbed by the water and has become latent heat.

On the other hand, where water is frozen into ice a large amount of heat is given out by it and becomes sensible, thus changing from latent to sensible heat.

The reason why the heating power of steam is so much greater than that of boiling water is because it contains so mnch latent heat which is rendered sensible again on the çondensation of the steam.

The heat of ice or snow may be felt by us as sensible

heat. Take for instance one pint of snow and then mix it with half as much salt, then plunge your hands into the mixture and you will find it so intensely cold that upon plunging your hand again into the snow the snow will feel warm in comparison.

### DRYING OF DRUGS.

The substances which are derived from the animal and vegetable kingdoms usually require to be dried before any use can be made of them as medicines.

All organic matter contains more or less water, water being everywhere present in both the animal and vegetable kingdoms, and at a temperature of from 90° to 100° F. produces changes in the principles of the drugs that bring about decomposition.

Albumen, starch and other substances present in vegetable drugs will, in connection with moisture and a warm temperature, undergo fermentation and decomposition.

In vegetable drugs the acids also will, in connection with the moisture present, produce mold. This fungoid growth is injurious to the active principles of the drug and consequently impairs its value.

These facts render it necessary to remove the moisture by evaporation, and thus destroy the principal cause of decomposition.

At 140° F. most of the causes of decomposition in drugs are rendered powerless to ferment, etc., by the action of the heat upon them, consequently when they

have been thus dried the drugs are said to be cured. The process of curing is generally effected by artificial means, as hot air, steam, etc.

Before drying, the roots or bulbs are sliced, the outer cork of the bark is removed, the rind is pared from the fruit, while leaves, seeds and flowers are generally dried whole. Thus prepared they are placed in a drying room and subjected to the action of steam or hot air.

In considering the rate of evaporation we must consider in the first place the amount of moisture in the air and the rapidity of the passage of the air through the drying chamber, the proper division of the substances and their affinity for water, as a compact drug, like opium, must be heated for a longer time than one more porous, as for example senna.

The heat applied to most roots is 140° F., but in drying drugs that contain delicate principles, such as belladonna, etc., the heat applied should not exceed 120°.

Great care must be used also in drying those drugs that contain volatile oils, lest their active principles, or the aromatics they contain, be driven off. The proper drying of a drug is of the greatest importance. It is often the case that vegetable drugs which have no virtues at all are found in pharmacies. The reason of this may be found in the fact that the drug was improperly dried. Therefore the druggist should be careful in choosing his drugs to select only whole drugs thoroughly dried and of the best quality, and in this way he will escape pecuniary loss as well as do justice

to his patrons. If he should discover any moisture about the drugs he should proceed at once to apply heat so as to properly and thoroughly dry them. All vegetable drugs must be carefully preserved from the damp air.

## GRINDING.

If fibrous roots and barks be cut transversely into small pieces (not over one-half inch in length), and then dried to a crisp state they may easily be powdered (to coarse powder) in an iron mortar, or, if one possess it, in a drug mill. Most of the roots and barks may be classed as fibrous drugs, while nearly all the herbs, flowers and leaves may be classed as cellular drugs. It is said to be almost impossible to reduce them to a uniform coarse powder, consequently in reducing them it is best to use the mortar. When only small quantities are desired to be used in preparing tinctures, etc., it is best to moisten them first with a little of the menstruum, as they can in this way be more quickly powdered in the mortar.

There are a few tubers known in strong drugs, such as gelsemium, collinsonia, etc., which the ordinary drug mill can not reduce properly, if it can be said to reduce them at all.

The gums, resins, etc., known as the fragile drugs, such as aecacia, aloes, etc., may be easily powdered, if dry, in a wedge-wood mortar. The natural extracts are classed as fragile drugs.

The flexible drugs, also sometimes called the horny

drugs, are chiefly seeds and low forms of organization, and can not be easily powdered, as, owing to their flexibility, they will pass almost unbroken through the mill, consequently it is best to use the mortar in reducing these.

Before proceeding to powder his drugs, and indeed at all other times, the pharmacist should be on his guard against adulterations. In doing so he may find portions of the stems of the vegetable among the roots and leaves, and these should always be carefully selected out and thrown away. It is said that these stems are frequently found in cimicifuga, leptandra, ipecac, gelsemium, etc.

Hydrastis, leptandra and valerian may sometimes have dirt adhering to their fibres. When this is so they should be carefully cleaned.

It is often the case that stems are to be found intermixed with those drugs that consist of leaves. In such cases it is necessary to separate the two, unless the stems contain principles similar to the active principles of the leaves.

Flowers and barks are cleanly, and are preserved with but little trouble. There is a certain season, however, for the cutting of barks, and if they are not cut in season the result will be very inferior bark.

Every attention should be given by the pharmacist in the selection of drugs to avoid adulterated articles. Dirt and inert parts of the plants, if not eliminated, render it impossible to make a standard preparation.

Accidental adulteration, such as dirt, etc., is easily detected, but where the adulteration is intentional the detection is not so easy, as in taraxacum, which is often largely adulterated with chicory (chicorium intybus). Care should be taken also in the case of valerian, the English (which is more valuable from a medicinal standpoint) often being adulterated by mixing with the German. In fact, in a matter so important as this to himself and patrons, the druggist should use every care lest he be imposed upon and be made the vehicle for vending adulterated drugs.

When it is possible the pharmacist should always purchase his drugs in bulk, since they are the more easily examined.

By far the greater number of substances employed in medicine belong to the vegetable kingdom, but the processes used in distinguishing these may often be applied to the inorganic substances described in the materia medica.

Marble mortars are also used as well as iron mortars, but care must be had in their use, as it is better not to put substances containing acid into them, as the acid will affect the marble and will probably affect the next substance put in it.

Lately a change has taken place in regard to powdering articles, and many articles which before it was considered necessary to reduce to a fine powder it is now considered necessary to only reduce to a coarse powder. The reason of this is that of late our process for extract-

ing the principles of the drug has so improved that a coarse powder is all that is necessary.

It is said that large quantities of opium, cinchona, ergot, etc., may be powdered by means of a mechanical contrivance, which is described as follows: "A hickory spring about six feet long and three inches wide at the base, that gradually tapers in width and thickness to about one inch at the end, is firmly attached to the rafter of the ceiling, about one inch from the base of the spring, which is blocked up four inches or less. A stout cord is now attached to the small end of the spring and fastened to the pestle handle (which should be provided with an eyelet). The cord must be of such length that when the spring is bent to its fullest capacity the pestle will reach the bottom of the mortar. The pestle is made to descend by the force of the hand, but is carried upward by the spring when the pressure of the hand is relaxed."

Squills and gum resins when powdered should be placed in bottles, tightly stopped, and should be kept in a cool place. They must be kept, however, in a place free from dampness, in fact it should be perfectly dry.

By powdering a substance we thereby present a larger surface of it to the action of the solvent liquid, consequently substances are more readily acted upon when reduced to a powder.

When we dry a drug by evaporating the moisture present, we have in the cells composing it its active principles, such as the alkaloids, resins and acids.

In order, therefore, to get at these active principles, it is necessary for us to first break down the walls of the cells in order that we may obtain the principles by solution.

Once the cell walls are ruptured then the solvent action of the liquid can have full play. It therefore follows that the "degree of fineness of a powder of any given drug should correspond with the size of the cells which make up its structure."

The degree of fineness of a powder of a drug is measured by the number of meshes to the inch which the sieve contains. In the case of very fine powder the sieve should contain eighty or more meshes to the linear inch. This is known as No. 80 powder. Fine powder, which passes through a sieve possessing sixty meshes to the linear inch, is known as No. 60 powder. Moderately fine powder, passing through a sieve possessing fifty meshes to the linear inch, is known as No. 50 powder. Moderately coarse powder, passing through a sieve possessing forty meshes to the linear inch, is known as No. 40 powder. Coarse powder—No. 20 powder—passes through a sieve with twenty meshes to the linear inch.

The No. of the powder always indicates the number of meshes to the linear inch of the sifter used in sifting it.

Dialysis is a process discovered by Graham (1861), by means of which substances which crystalize may be separated from those which do not. This is done by

placing a mixture of the two on a porous diaphragm, the under surface of which is in contact with water. Those substances which pass through the diaphragm are termed crystalloids; those which do not are termed colloids. Sugar is an example of the crystalloids or substances having the crystalline form; glue and gum are examples of the colloids.

A thin layer of gelatin or parchment paper placed between two liquids will allow the crystalloids to pass freely from one to the other, while the colloids will remain where they are.

Parchment paper, it is said, may be prepared by "immersing unsized paper in a cold mixture of two measures of sulphuric acid and one of water, and subsequently washing it thoroughly to free it from acid."

The entrance and outflow of a liquid through the cell walls of a drug charged with its active principles is termed *osmosis*, and by means of this property we may often obtain solutions of the constituents of a drug without reducing it to a powder corresponding in fineness to the size of its cells, as for instance when the constituents of the drug are soluble in water.

The principles of many drugs, as the alkaloids, resins, etc., are only slightly soluble, if at all, in water, consequently it is necessary to use a menstrua for their extraction that will dissolve them. Alcohol is used for this purpose. It is necessary, however, to powder them finely, as osmosis does not assist us here, and we have only the solvent action of the alcohol to rely upon, and

if not finely powdered the exhaustion of the drug will not be complete.

In the case of drugs whose active principles are soluble in water a moderately coarse powder will be sufficient.

### VAPORIZATION.

By means of vaporization volatile substances may be separated, not only from fixed bodies, but from those which are less volatile, by the application of various degrees of heat. Vaporization is an important factor in many pharmaceutical operations. Prof. Remington, in his excellent work on the "Practice of Pharmacy," gives the following as the applications of vaporization in pharmacy in the order of their importance: (1) To liquids; (2) to solids.

"1. When vapoiization is used to separate a volatile liquid from a less volatile liquid it is called evaporation.

2. When the object sought is the volatile liquid it is called distillation.

3. When used to separate a volatile liquid from a solid it is called desiccation, exsiccation, or granulation.

4. When it is used to separate a volatile solid from another solid it is called sublimation."

The term evaporation, however, as generally used, means the separation of moisture from any substance, solid or liquid; in pharmacy, however, it has a more restricted meaning, and applies to the driving off of the volatile or the less valuable portions of a liquid by means

of heat—the object being to purify it or to obtain the non-volatile portion.

The boiling point of a liquid sometimes becomes important in order to identify it or to determine its purity.

The amount of pressure exerted upon the surface of the liquid and its cohesion must both be taken into consideration when considering its boiling point. Water confined in a steam boiler has been heated to considerably more than 392° F. without boiling; the reason of this was that the pressure of the steam in the space above it prevented the bubbles from rising on account of the pressure. On the other hand, remove the pressure and water may be made to boil at a point below 212° F., its boiling point, as for instance where the mercurial barometer falls below 30 inches, showing a diminished pressure of the atmosphere, the water will boil at a lower temperature.

Such fragile vessels as flasks and beakers, when hot, should not be placed in contact with such things as are good conductors of heat, as marble or metal, as they abstract the heat so rapidly they may fracture them. Care must be had also in placing hot water in such vessels. For these reasons the top of the table used in the laboratory should be made of some non-conducting substance.

If a vessel is composed of a material which is a good conductor of heat the liquid will heat more easily than if it were composed of porcelain, earth, or some other

slow conductor. A smooth or bright surface also will not heat so readily as a dark and rough one.

When an open vessel is used in the case of boiling without pressure, the temperature of a liquid can never be raised above its boiling point, since the surplus heat applied to it is used in evaporating the liquid. A cubic inch of water by evaporation is converted into about 1700 cubic inches of steam.

Heat and the removal of pressure have the effect of converting liquids into vapor, while cold and pressure have the reverse effect.

## Questions to Lecture II.

1. What part does heat play in pharmacy?
2. How is heat known?
3. What is a molecule? Also an atom?
4. How many, and in what states does matter exist?
5. What bodies contain heat?
6. What is the principal cause of decomposition in drugs?
7. What are flexible drugs?
8. How are natural extracts classed?
9. What is known as No. 60 powder?
10. What surface heats the most readily?

## Answers to Questions on Lecture II.

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1. That branch of knowledge which includes those sciences and arts necessary to the proper compounding and preparation of drugs and medicines.

2. Practical pharmacy is the practical application of the knowledge obtained in the study of theoretical pharmacy.

3. No.

4. A commentary on a pharmacopœia.

5. That of another of equal bulk at 60° F.

6. It is the opposite of specific gravity.

7. Fahrenheit's.

8. One grain.

9. Gallon, Cong.; Pint, O.; Fl. oz., Fl. ℥.

10. Latin prefixes are used to represent those below one gram and Greek prefixes those above one gram.

# PHARMACY.

## Lecture III.

### EVAPORATION.

The process by which a solution is reduced in dimensions or brought to a closer union by means of heat, is termed *evaporation.*

Concentration is caused by the evaporation of the liquid parts of the substance, and as stirring helps to present a greater surface of the liquid to the influence of the heat and the atmosphere, it consequently is a great help where evaporation is required; for this reason the evaporating dish should be shallow, so as to present as large a surface as possible to the influence of the heat and the atmosphere.

As stated, when water is heated to the boiling point (212° F.) in an open vessel, its temperature can never be raised above its boiling point, the surplus heat being employed in evaporating the water. If a closed vessel be used, however, and the pressure thus be increased, a much higher temperature may be reached. Decoctions are made by boiling the substance in water in a

vessel "with the cover loosely put on until the boiling is complete, when the vessel should be well closed." Infusions are prepared "by pouring boiling water upon the materials, allowing them to remain in contact for a proper length of time," and strained.

A cubic inch of water, by evaporation, is converted into about 1,700 cubic inches of steam, and the force thus exerted is equal, at the same temperature and pressure, to the lifting of about 27,000 pounds one foot high. A late writer says that "Steam as a source of heat contains 967.5° F. of latent heat. By contact with a cold surface it is condensed until the surface is heated to 212°. * * * Theoretically, steam in the act of condensing will heat nearly ten times its weight of water 100° F. Twenty pounds of steam condensed in two hundred pounds of water at 112° F., will raise the temperature of the water to 212° if no loss is sustained."

All matter gives out heat to the matter surrounding it, and water when heated will impart its heat to whatsoever substance it comes in contact with, until the substance has the same temperature of the water. In order, however, to raise the temperature of the substance to be heated to the original temperature of the water more heat must be applied; hence the use of the *water bath* as a source of heat in pharmaceutical operations. This is accomplished by placing a smaller vessel containing the substance to be heated inside a larger one containing a proper amount of water, and the water on being heated imparts its heat to the sub-

stance until it is heated in a ratio slightly *less* than the temperature of the water.

Saturated solutions of the different salts require more heat than water to reach the boiling point. These are known as *saline baths.* A saturated solution of sodium carbonate, for instance, boils at 220°; a saturated solution of ammonium chloride at 236°, etc.

By means of these baths a substance may be heated higher than can be done by the water bath. They are also of advantage when a very regular heat is required. When a uniform heat is kept up the temperature of these baths does not change so long as care is taken to supply water sufficient to keep all but a small portion of the salt in solution.

The *steam bath* in some cases of evaporation, is frequently of benefit, as it affords a range of temperature equal to the pressure which the vessel containing it is capable of sustaining.

THE OIL BATH.—Where a temperature not over 500° or 600° is desired, a bath of certain fixed oils may be used, as olive oil, etc., as they reach this temperature before boiling.

THE GLYCERIN BATH.—As the boiling point of glycerin is 554°, it is also useful in the practice of pharmacy.

SAND BATH.—Where it is thought that a steady, regular temperature cannot be obtained by means of an open fire, when extreme heat is desired, the sand bath is employed.

## DISTILLATION.

The process by which a liquid substance is separated from other substances by evaporation is termed *distillation.*

The product of this process is termed a *distillate.*

The vessel used in the process of distillation is known as a still. A flask with a lengthened curved neck, known as a retort, is also used.

The still is made of metal, while the retort is of glass, and is employed in the distillation of acid and corrosive liquids and substances whose distillation require a high temperature.

A simple retort has but one opening, that at the end of the elongated neck.

A tubulated retort also has an aperture (tubulure) in the top, closed with a ground glass stopper, the purpose of which is to enable the operator to replenish the substance to be distilled.

CONDENSATION.—When a vapor, by exposure to a cold temperature, is condensed or converted into a liquid, the process is termed *condensation.* In distilling a liquid it is necessary to use some artificial means for condensing its vapor. The apparatus for effecting this is termed a *condenser.*

A condenser is simply a tube or coil attached to the neck of the still for the purpose of carrying the vapor through water, or some cold substance, into the receiver.

The *worm* is a form of condenser, consisting of a coil

of tubing of copper, earthenware or glass, and placed in a vessel of running water.

The distillation of a solid substance is termed *sublimation.*

Easily volatilized substances are refined in their crude state by sublimation, and chemical compounds may be separated by the same means. Care, however, must always be taken in the application of heat, as the volatilization of different substances depends upon different degrees of heat.

Where two or more liquids have different boiling points, their separation by distillation is termed *fractional distillation.*

By inserting a thermometer in the boiling liquid, and thus ascertaining its temperature, we may collect the substances in different vessels as they pass over at different temperatures. In this way alcohol, ether and water may be separated from each other, as there is a great difference in their boiling points. As the desire of the operator is to concentrate the volatile part of the matter, the apparatus used in distillation should be "vapor tight." As the ordinary stills used in pharmacy are made of tin generally, or of copper, every care should be taken on this point, as they are usually made in two parts, and the operator should be careful that they fit perfectly true.

Always be certain you have plenty of water at hand to condense the vapor, and see that the condensation is complete. If the water around the condenser becomes warm renew it at once.

The increase of temperature should always be gradual, and for this reason a water bath, if possible, is best, as the heat may thus be easily regulated. It is best, also, to prevent foaming and boiling over, to fill the still or retort only about two-thirds full.

### FUSION, ETC.

The temperature at which any substance changes its form from a solid to a liquid is termed its melting or fusing point. This point varies with the substance, as some substances melt at a low point and others at a high point, while some, as carbon for instance, can not be liquified at the highest degree of heat that we are able to produce. These are said to be *infusible.*

Iron, wax, etc., soften gradually before they fuse, while lead, copper, etc., melt without softening. This property is of value to iron workers, enabling them to weld or mould iron to the desired shape.

In preparing ointments and similar substances care must be had as to overheat, as, after fusion, the temperature will continue to rise unless the heat is regulated or its source is removed.

The water bath is the best means of applying heat where the melting point of the substance is under 212°. Platina dishes, crucibles, etc., are used when it is desired to fuse a substance that requires a high temperature.

The temperature at which the solid fats of the U. S. P. melt is as follows:

| | |
|---|---|
| Adeps (lard) at about . . | 95° F. |
| Cacao butter, . . . | 86° to 95° F. |
| Cera alba (white wax) . . | 149° F. |
| Cera flava (beeswax) . . | 145° to 147° F. |
| Petrolatum . . . . | 104° to 125° F. |

Some crystalline substances on exposure to a dry atmosphere become powdered; this is termed *efflorescence.* It may be prevented by keeping them in some air-tight container or bottles that are tightly stopped.

The driving off of a volatile substance by means of heat from a solid substance is termed *calcination*, and the remnant left is said to be *calcined.* The process of calcination is of advantage chiefly in expelling carbonic acid from its compounds.

Certain substances absorb moisture until they gradually pass into a liquid state; this is termed *deliquescence.* These should be carefully noted and kept in air-tight containers. *Hygroscopic* is a term applied to those solid bodies which attract moisture, but by reason of their inferior solubility do not pass into a liquid state.

### SOLUTIONS.

As the reader has probably noticed, common salt (chloride of sodium), in certain quantities, when placed in water, will melt or dissolve. The mixture thus formed is termed a *solution.* This is true as to other bodies as well as of common salt, and the liquid in which the body thus dissolves is called a *solvent.* The

specific gravity of the liquid is always increased in such cases.

In the case of solution proper the change is merely mechanical, no chemical change occurs, and the solid may be easily recovered from the solvent by means of evaporation. Solution, however, is often accompanied by chemical change. In this case the solid enters into combination with the liquid. It is then called a *chemical solution;* or, as some authors term it, a complex solution. The student must remember, however, the difference between a simple solution and a chemical solution or combination.

In a simple solution the molecules of the solid, by virtue of the attraction exerted upon them by the molecules of the liquid or solvent, become separated or diffused throughout the liquid.

In a chemical solution, however, a new force is developed—chemical affinity. Compounds are formed and the properties of the old body changed by the action of the solvent.

In the case of a solution a lowering of the temperature always results, while in the case of chemical combination a higher temperature is the result. Where, as in the case of certain anhydrous salts, a rise of temperature occurs on solution, this exception to the general rule is caused by a chemical combination taking place between a portion of the water and the salts.

The lowering of temperature when solution occurs may be seen in the case of freezing mixtures; for in-

stance, when common table salt is dissolved in snow, generally a temperature of about 37° degrees below the freezing point is produced.

When the solvent refuses to dissolve the substance any further it is called a saturated solution. A solution, however, although saturated with one substance, may still prove a solvent for another.

It is laid down as a general rule that "whatever weakens cohesion promotes solution." This may be effected by means of pulverization, for by pulverizing the substance a larger extent of surface is presented to be acted upon, while its cohesion is also weakened. Rapid solution is frequently favored by agitation, as the particles of the substance are thus brought into closer contact with the particles of the liquid or solvent. Heat also weakens cohesion and consequently promotes solution: it also causes convection currents in the liquid and so facilitates solution.

In the case of circulatory solution the substance is placed in a bag and suspended in the solvent. As fast as it dissolves the specific gravity of the liquid nearest it is increased and it sinks to the bottom, while the lighter liquid rises; a current is thus formed, the saturated solution sinking to the bottom and the unsaturated part rising to contact with the substance to be dissolved.

As to the solvents that are used in pharmacy, water occupies the first place; next are alcohol, glycerin, ether, benzine, chloroform, bisulphide of carbon, acid and oils, in their order,

In the case of a solution of gas in water, the gas must first pass through a wash bottle; it is thus purified and bubbles up through the solvent, which absorbs a certain quantity of it during its passage through it.

### CRYSTALLIZATION

is the process whereby certain substances are caused to arrange themselves in regular geometric forms called crystals. Substances which do not crystallize are termed *amorphous*. The object of this process is to increase purity and to enhance the beauty of chemical substances. It is impossible here to give more than a very brief sketch of the outlines of the classification.

Crystals may be formed in a variety of ways. By sublimation camphor, iodine, etc., may thus be freed from foreign matter. By fusion such substances as sulphur, antimony, etc., assume the crystalline form on cooling. The most important application of the method is by cooling from solution or evaporation of the solvent. In the former case a saturated solution of the substance is prepared and placed in a shallow vessel at an elevated temperature and allowed to stand until cold. After the crystals are formed the mother liquor is drained off, and is concentrated by heat and again allowed to cool, and this process is repeated so long as crystals form. Where the solution is highly volatile, as ether, benzole, etc., a cold saturated solution is made and the other solvent allowed to evaporate spontaneously. Crystals are also formed by chemical reaction in solutions when

an insoluble or less soluble substance is formed, appearing as a precipitate. The crystals thus formed are granular.

PRECIPITATION

is the process whereby an insoluble compound is formed by mixing the solutions of two soluble substances. The product is termed a *precipitate*. The term precipitation is also applied to any substance which has been thrown out of solution from a liquid, as precipitates in fluid extracts, tinctures, etc. New compounds are formed when precipitation is the result of chemical decomposition. This method is only employed when the product desired is known to be insoluble, as for example, a solution of iodide of potassium is mixed with a solution of acetate of lead, chemical changes take place and new compounds are formed; lead iodide, which is insoluble, is precipitated, and potassium acetate, which, being soluble, remains in solution, and is separated either by filtration or decantation. Precipitates are collected and washed, in small quantities, upon plain filters; on a large scale, muslin strainers are employed.

When we separate a liquid from a solid substance by pouring the liquid off, the operation is termed *decantation*. This may often be effected better by means of a siphon.

A siphon is simply an inverted U tube, with one arm shorter than the other. In order to use it, the siphon

must first be filled with the liquid, then immerse the shorter arm in the liquid and a current will thus be established. This is created by the column of liquid in the longer arm overbalancing that in the shorter arm, and the current thus created will continue until the vessel is emptied.

*Colation*, or straining, is the process of separating a liquid from a solid substance by means of a cloth or other porous substance. Gauze, muslin, flannel, felt, etc., may be used in this operation.

When it is desired to separate a liquid from a solid, in order to obtain the liquid in a transparent state, the operation is termed *filtration*. Paper, paper pulp, sand, asbestos, ground glass, charcoal, porous stone, etc., are used for filters. The filter is supported by a funnel. In order to promote rapid filtration various methods are used, such as suction, which produces a partial vacuum beneath the filter and thus hastens the process by increasing atmospheric pressure. The nature of the filtering medium used depends upon the mobility of the liquid and the character of the undissolved matter. With aqueous, alcoholic, ethereal and similar liquids, when not too concentrated, filter paper is used. There are two kinds of filter paper—grey and white. When the process of filtration is applied to viscid substances, as oils, syrup, etc., it is termed straining. Filtration is favored by the careful folding of the filter. The labor spent in properly folding the paper will be repaid tenfold in saving of time and diminish-

ing the evaporation. The filter should be thoroughly moistened before filtration is commenced. The fibre of filter paper, owing to its porosity when dry, absorbs considerable water in filtering aqueous solutions; therefore, the solid which was held in solution is left more or less dissolved in the pores by the attraction of the water, thus preventing the penetration of the liquid. The best way to moisten a filter is as follows: The filter properly folded is completely opened out and then pushed into the neck of the bottle by gentle pressure, and a small stream sent into it by a spritz or wash bottle. In filtering provision must be made for the escape of the air from the receiving bottle. The more liquid in the filter the greater the pressure and the more rapid the filtration. Keep the funnel well covered to prevent evaporation. The paper should never extend above the top of the funnel. Many devices are in use for facilitating filtration, as racks, supports, etc., but these do not insure such rapid filtration as the simple funnel and attention to the above rules. When large quantities of a liquid are to be filtered the process of continuous filtration is employed. The filtration of oils is effected by hot or cold process. The cold process requires such substances as flannel, cotton, etc. But few oils can be filtered by this process, since they contain a large quantity of gum; but by the use of the water bath filter the process is effected with little difficulty. Care must be taken, however, lest too high a temperature occur during the process, as the substance may become cloudy when cooled.

Hot or water bath filters are made in various ways; the most common method, however, is to place an ordinary funnel in a double or jacketed cone of tin filled with water, having a projecting tube attached, which is heated by a spirit lamp generally, or a gas jet.

Absorbent cotton is also used for a filter in cases where the liquid is not too glutinous, acid or alkaline.

In pharmacy the solubility of any substance is determined by the percentage of quantity required to saturate a certain amount of distilled water at 50° F. Therefore, when the solubility of a body is mentioned, it is always understood to refer to its solubility in water, unless some other solvent is mentioned. The solubility of bodies differs widely, a few being insoluble. A substance, however, that is but sparingly soluble in one liquid may freely dissolve in another. Gum camphor is a common illustration of this subject. It is dissolved only in a small degree by water, but in alcohol it is soluble in large quantities. Change of temperature affects the solubility of most substances; sometimes solubility increases faster than the temperature, and then again, with heat, it increases to a certain point and then declines.

When a solvent contains more of a salt than it would dissolve at a given temperature, it is said to be *supersaturated.* The term supersaturated is also used in the case of an acid to which more of an alkali has been added than is necessary to neutralize it.

Diffusion of one liquid through another is due to

molecular attraction, and may be regarded as of the same nature as solution. Liquids vary widely in their power to diffuse. The fixed oils, for instance, are insoluble in water, the volatile oils only slightly so, while other substances, as the syrups, etc., mingle with it freely.

## DIALYSIS.

The interposition of an animal or vegetable membrane that possesses the capability of being wet by both liquids, between the two, modifies while it does not prevent diffusion. These membranes, possessing as they do a multitude of small pores, enable the liquids to come in contact and thus mingle. The commingling of liquids in this manner is called *osmose.* The rapidity of the currents passing through the membrane will depend on the density of the liquids and their power of wetting it, the stronger current being toward the denser liquid. Dialysis may, therefore, be termed the separation of a crystallizable substance from a non-crystallizable by osmosis. Crystallizable subsubstances are termed crystalloids. They diffuse readily through the membrane. Sugar, salt, etc., are examples. Colloids are non-crystallizable substances. Glue, gum and starch are examples. It therefore becomes possible, by means of osmose, to separate the colloids from the crystalloids. The distilled water when impregnated, is termed diffusate. The dialyzer, as may be seen from illustrations of it, is formed of two

vessels, one suspended in the other, and the outer containing the distilled water or liquid in which it is desired to obtain the crystallizable substances. The dialyzer proper, thus suspended, has at one end a parchment head, and the substances to be suspended are placed in it in the form of solution. By osmosis the crystallizable substances transude through the pores of the parchment into the water and leave the non-crystallizable substances behind. This process is used in pharmacy in the preparation of dialyzed iron and of some alkaloids.

The simple diffusion of liquids, where chemical change does not occur, usually causes no change of temperature. In the case of equal volumes of alcohol and water contraction occurs with a rise of temperature. The diffusion of gases through liquids—due to molecular attraction—is termed absorption. In cases where a great quantity of gas is absorbed by a liquid a rise of temperature occurs as the absorbed gas is condensed in volume and a portion of its latent heat is rendered sensible. Usually an elevation of temperature facilitates solution, while a lowering of the temperature increases the absorption of a gas. Pressure also has the same effect.

## EXTRACTION.

Extraction includes all the processes by means of which the soluble matters of a vegetable drug may be obtained, separate from the insoluble part. There are

several ways by which extraction may be accomplished:

1. Maccration and expression.
2. Percolation or filtration.
3. Or by combining these processes.

Maceration consists in soaking a drug (in the form of a coarse powder) in a solvent until the soluble portions are dissolved.

Expression is the process of forcibly separating a liquid from a solid. This is done by straining, either through a suitable cloth—pressure being exerted by the hand—or by means of a screw press. A coarse powder should always be used in maccration, as small powders will swell and adhere to each other as soon as they come in contact with the liquid.

Infusion is the process of maccrating a drug by means of boiling water for a short time in a well-covered vessel. If the active principles of the drug, however, are injured by heat, they should be macerated in cold water. When a moderate heat is used in the process of maccration, the process is called *digestion;* but if the mixture is effected by means of boiling the liquid, the product is termed a decoction.

PERCOLATION.

Percolation, or, as it is sometimes called, *displacement*, is one of the most important of pharmaceutical processes. In speaking of it Prof. Remington says, in his treatise on the "Practice of Pharmacy," that "The importance of this process cannot be overestimated, as

the progress made in pharmacy in America during the last half century is largely due to the study and development of percolation and the introduction of preparations which are the direct outgrowth of the process." It is also the best and most convenient process for extracting the medicinal principles of drugs. Percolation is the process of obtaining the soluble matter of the drug by exposing it to the solvent action of a liquid in a vessel which is called a percolator. The liquid obtained is called a *percolate.* This process is of great benefit in pharmacy for the preparation of tinctures, fluid extracts, etc. The powdered drug is placed in a cylindrical vessel, having a porous diaphram at its lower extremity, and its soluble portions are obtained by means of a solvent passing through it, which, as it descends, exercises its solvent power on the successive layers of the powder until it is saturated. The solvent is termed a *menstruum*, and the liquid product is collected by means of a rubber tube passing to a receiver.

The soluble principles of the drug, generally contained in cells, are more or less disintegrated by grinding, being in a dry, hard state, and are thus placed in a favorable condition for the action of the menstruum.

The exhaustion of a drug is generally ascertained from the color and taste of the percolate.

For common use the best percolator is an ordinary glass funnel. For fluid extracts, however, a tall, narrow percolator is the best, as it is desirable that the menstruum should traverse a tall column of powder, as

by this means every drop of the menstruum is most economically applied; the rate of flow is also diminished.

*Fractional percolation* is a term used when percolation is applied to two successive portions of a powder, and was introduced by Dr. E. R. Squibb. In this process the drug is divided into four different parts and placed in four different percolators, and the weak percolate obtained from each is used for the purpose of moistening and extracting each succeeding portion, the first part of the percolates being withheld and at last mixed with the percolate obtained from the last percolator, when, it is said, "their combined volume corresponds with the weight of the drug." In percolation care must always be had as to the fineness of the drug and as to its packing. The flow of percolate may be regulated by raising or lowering the end of the tube in the receiver, and may be entirely stopped by raising it to a level with the solvent in the percolator. Care should always be taken to moisten the drug before percolation. This is done by spreading it out in some proper receptacle and moistening until its particles will adhere together. After moistening, before being placed in the percolator, it must be sifted through a coarse sieve, the adherent particles being rubbed through with the hand. Moistening, however, must be avoided if the solvent, on being added, would cause lumping, as in the case of sugar and water, or if the moistening of the powder would render it too loose for

proper packing. Reference must be had also as to the inflammability and volatility of the menstruum. The menstruum is usually alcohol or diluted alcohol, glycerin being added in some cases. If the menstruum contain more of alcohol than of water it is said to be *alcoholic*; on the other hand, if it contain more of water than of alcohol, it is termed an aqueous menstruum. The menstrua (plural of menstruum), as directed by the U. S. P., should always be used in all officinal preparations. The absorbed menstrua may be recovered if desired, either by distillation or by treating the residue with weak alcohol and then with water. The recovered distilled alcohol may be purified by treating it with permanganate of potassium, allowing 12 grains to the gallon. After standing a few days it may be decanted or filtered.

Sometimes water causes the substance to swell, thus impeding or preventing percolation; in case this occurs mix the residue with rice chaff or dry sawdust, or some similar substance, and then percolate with water.

Directions upon percolation may be found in the U. S. P.

## SOLUTIONS AND MIXTURES.

A large number of preparations which are officinal in the U. S. P. are known as pharmaceutical preparations; they are also called galenic preparations, since no chemical change occurs in their preparation. They may be divided, with reference to the arts re-

quired for their preparation, into three classes, as follows:

1. Solutions and mixtures.
2. Products by extraction.
3. Mixtures of solids to assume various forms.

Solutions are termed aqueous, alcoholic, acid, vinous, and glycerites and syrups, according to the solvent used in their preparation.

The waters, infusions, decoctions, mucilages and liquors constitute the aqueous solutions.

Taking them in their order, we come first to the officinal waters. Of these there are three kinds:

1. Pure waters—Aqua and aqua distillata.
2. Chemical waters—Aqua ammoniæ, containing 10 per cent. $N. H_3$.
   Aqua ammoniæ fort., containing 28 per cent. $N. H_3$.
   Aqua chlori, containing 0.4 per cent. Cl.
3. Aqua creosoti, containing 1 per cent. creosote.

These are simply solutions of the water with the gases, except aqua creosote, which is a liquid solution, creosote being a liquid.

For testing and preparing aqua and aqua distillata see directions in the U. S. P.

The medicated waters are described as being "more or less saturated solutions of essential oils in distilled water."

For a description of the process by means of which the solution of the oil is effected, see Remington's Treatise on Pharmacy, page 247.

The following table contains those which are officinal, with the per cent. of oil which they contain:

Aqua Anisi—Oil of anise 0.2 per cent.

Aqua Camphora—0.8 per cent of camphor dissolved in alcohol.

Aqua Cinnamoni—Oil of cinnamon, 0.2 per cent.

Aqua Fœniculi—Oil of fennel, 0.2 per cent.

Aqua Menthæ Peperitæ—Oil of peppermint, 0.2 per cent.

Aqua Menthe Viridis—Oil of spearmint, 0.2 per cent.

Aqua Amygdalae Amaræ—Oil of bitter almond, 0.1 per cent.

These waters may be obtained also by distillation, and where possible this process should always be preferred, it being the best.

Aqua Aurantii Florum is directed to be distilled. The table below is from Prof. Remington:

Aqua Aurantii Florum—40 per cent. fresh orange flowers.

Aqua Distillata—800 parts distilled from 1,000 parts of water,

Aqua Rosæ—40 per cent of pale rose.

## INFUSIONS.

Infusions are prepared by treating the drugs, in the form of a coarse powder, with either hot or cold water. They soon become decomposed, and care should be taken not to prepare in too large a quantity.

Where neither the physician nor the Pharmacopœia prescribe the strength of an ordinary infusion, the U. S. P. directs, for general use, the following officinal formula:

Take of—

The substance, coarsely comminuted, 10 parts, or.. 1 oz. av.
Boiling water, 100 parts, or............................10 fl. ozs.
Water, a sufficient quantity to make 100 parts, or..10 fl. ozs.

The substance should be placed in a vessel containing a cover, and boiling water poured over it, and allowed to stand two hours, after which it should be strained and water sufficient added through the strainer to make the infusion weigh 100 parts, or 10 fluid ounces.

In the case of energetic and powerful substances the strength of infusions should always be prescribed by a physician. The infusions here given are officinal in the U. S. P.:

Infusum Brayeræ—6 to 100, or 6 drams to about 12 ozs. apoth.

This infusion is more effectual without straining, and hence should be dispensed unstrained.

Infusum Digitalis—Digitalis and cinnamon, of each 1.5 to 100, or 86 grains to 12 ozs. apoth.

With the addition—

| | |
|---|---|
| Infusum Sennæ Comp. | To 100 drams or 12 ozs. |
| | Senna.......... ........ ...... 6 drams |
| | Fennel........................ 2 drams |
| | Magnes. sulph...............12 drams |
| | Manna...... .................12 drams |

Infusum Cinchona (cold)—6 drams to 100, or 12⅓ ozs., with the addition of 1 dram acid sulph. arom.

Infusum Wild Cherry—4 drs. to 100.

UNOFFICINAL INFUSIONS.—These, in cases where the strength is not prescribed, may be prepared 4 drams to 8 ozs. Infusum gentian comp. is usually prepared from a tincture of quadruple strength. The other unofficinal infusion is the infusum rose comp.

## DECOCTIONS.

Decoctions are prepared by *boiling* vegetable substances in water.

*General Officinal Formula.*—"An ordinary decoction, the strength of which is not directed by the physician nor specified by the Pharmacopœia, shall be prepared by the following formula:

Take of—

The substance, coarsely comminuted, 10 parts, or.. 1 oz. av.
Water a sufficient quantity to make 100 parts, or...10 fl. ozs.

Put the substance in a suitable vessel, provided with a cover; pour upon it 100 parts (or 10 fluid ounces) of cold water; cover it well and boil for fifteen minutes; then let it cool to about 45° C. (113° F.), strain the liquid, and pass through the strainer enough cold water to make the product weigh 100 parts (or measure 10 fluid ounces).

*Caution.*—The strength of decoctions of energetic or powerful substances should be specially prescribed by the physician."

The following decoctions are officinal:

| | | In 100 parts. |
|---|---|---|
| Decoctum cetrariæ | | 5 |
| Decoctum Sarsaparilla comp. | Sarsaparilla | 10 |
| | Sassafras | 2 |
| | Guaiacum wood | 2 |
| | Glycyrrhiza | 2 |
| | Mezereum | 1 |

LIQUORES--SOLUTIONS.

This class contains all the aqueous solutions of non-volatile substances except the naturally distinct classes, such as the syrups, infusions and decoctions. For the processes and formulas in reference to this class the student is referred to the U. S. P. They are prepared either by simple solution or by the chemical decomposition of substances in water, thus forming new compounds.

The following are officinal in the U. S. P. The percentage they contain of the substance is given:

1.—*Simple Solution* (aqueous).

| | Per cent. |
|---|---|
| Liquor acidi arseniosi | 1 |
| " arsenii et hydrargyri iodide (of each) | 1 |
| " calcis, saturated solution Ca 2 HO... | |
| " ferri et quinine citratis | 38.5 |
| " iodidi compositus | 6 |
| " pepsini | 4 |
| " plumbi subacetatis dilutus | 3 |
| " potassæ | 5.6 |
| " sodæ | 5.6 |
| " sodii arseniatis | 1 |
| sodii silicatis—nearly saturated solution. | |

2. *Chemical Solution* (aqueous).

| | | |
|---|---|---|
| Liquor | ammonii acetatis | 7.5 |
| " | ferri acetatis | 23 |
| " | ferri chloridi | 37.8 |
| " | ferri citratis | 35 5 |
| " | ferri nitratis | 2 5 |
| " | ferri subsulphatis | 43.7 |
| " | ferri tersulphatis | 28.7 |
| " | hydrargyri nitratis | 50 |
| " | magnesii citratis (see formula) | |
| " | plumbi subacetatis | 25 |
| " | potassæ | 5.6 |
| " | potassii citratis | 9 |
| " | potassii arsenitis (of arsenic) | 1 |
| " | sodæ | 5 |
| " | " chloratæ (Cl.) | 2 |
| " | zinci chloridi | 50 |

3. *Solution in Chloroform.*

Liquor Gutta Percha.—A saturated solution of gutta percha in chloroform.

SYRUPI—*Syrups.*

Syrups are concentrated solutions of sugar in which medicinal substances are dissolved. *Syrupus*, or simple syrup, is a saturated solution of sugar in distilled water. The U. S. P. gives the following formula for its preparation:

Sugar in coarse powder, 65 parts, or.......... 5 lbs. av.
Distilled water, a sufficient quantity to make
100 parts, or ..................................5 pts. 10 fl. ozs.

Dissolve the sugar with aid of heat in 35 parts (or 40 fl. ozs.) of distilled water, raise the temperature to the

boiling point and strain the solution when hot; then incorporate with the solution enough distilled water, added through the strainer, to make the syrup weigh 100 parts (or measure 5 pts. 10 fl. ozs.). Syrup thus prepared has the sp. gr. 1.310.

The officinal syrups are divided according as they are obtained, (1) by simple solution; (2) by extraction; and (3) by chemical process, when they are termed chemical syrups.

When the water contains soluble principles of medicinal substances the syrup is termed a *medicated* syrup.

To the first class, which are obtained by mixing a solution of the drug with syrup belong—

| | | In 100 parts by weight. |
|---|---|---|
| Syrup accaciæ—mucilage accaciæ | | 25 |
| " acid citric | acid citric | 0.8 |
| | sp. lemon | 0 4 |
| " auranti florum, aq. aur. flor | | 35 |
| " ipecacuanhæ—fluid extract. | | 5 |
| " krameriæ—fluid extract | | 35 |
| " lactucariæ—fluid extract | | 5 |
| " rhei aromatic—tincture | | 10 |
| " rosæ—fluid extract | | 10 |
| " rubi—fluid extract | | 20 |
| " senegæ | fluid extract | 16 |
| | ammonia water | 0.4 |
| " zingiberis—fluid extract | | 2 |

The syrups prepared by extraction are:

| | In 100 parts by weight. |
|---|---|
| Syrup allii, extracted with dil. acetic acid | 15 |
| " althæ | 4 |

| | | |
|---|---|---|
| Syrup amygdalæ | sweet almonds | 10 |
| | bitter almonds | 3 |
| | orange flower water | |
| " auranti | | 5 |
| " lemons, lemon juice | | 40 |
| " " " peel | | 2 |
| " picis liquidæ | | 6 |
| " pruni virginianæ | | 12 |
| " rhei | rhubarb | 9 |
| | potass. carb | 0.6 |
| | cinnamon | 1.8 |
| " rubi idæi, raspberry juice | | 40 |
| " sarsaparillæ comp. | sarsaparilla | 15 |
| | guaiac wood | 2 |
| | pale rose | 1.2 |
| | glycyrrhiza | 1.2 |
| | senna | 1.2 |
| | anise, gaulth. sass. (each 6) | 1.8 |
| " scillæ—vinegar squill | | 40 |
| " scillæ comp. | squill | 6 |
| | senega | 6 |
| | tartar emetic | 1.5 |
| " sumac | fluid ext | 33 |
| | oil coriander | |
| " tolutani | | 4 |

*Chemical Syrups.*

| | | In 100 parts by weight. |
|---|---|---|
| Syrup acid hydriodic | | 1 |
| " calcis lactophos | | 2.5 |
| " calcis | | 5 |
| " ferri bromidi | | 10 |
| " " iodidi | | 10 |
| " ferri, quininæ et strychninæ, phosphatum | iron phosphate | 1.33 |
| | quinine | 1.33 |
| | strychnine | 0.04 |
| | ac. phosphoric | 8 |

| | | |
|---|---|---|
| Syrup hypophosphitum | calcium hypophos | 3.5 |
| | sodium | 1.2 |
| | potassium | 1.2 |
| | spirit lemon | .2 |
| | acid citric | .1 |
| " hypophosphitum cum ferro | lactate of iron | 1 |
| | syr. hypophos. | 99 |

## Questions to Lecture III.

1. What benefit is derived from steam, oil and similar baths?

2. State the difference between a deliquescent substance and a hygroscopic substance.

3. When the solubility of a body is mentioned, in what is it understood to be soluble?

4. What is the diffusion of gases through liquids due to?

5. What kind of a powder should be used in maceration?

6. What is digestion?

7. Of what benefit is percolation to pharmacy?

8. What are galenic preparations?

9. When neither physician nor pharmacist prescribes the strength of an ordinary infusion, how should it be prepared?

10. What is the difference between a decoction and an infusion?

## Answers to Questions on Lecture II.

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1. Without its aid many pharmaceutical operations could not be accomplished.
2. Only by its effects on matter.
3. A molecule is formed of several atoms united together. An atom is such an ultimate portion of matter as is no longer separable into parts.
4. In three—solids, liquids and gases.
5. All bodies, in varying quantities.
6. Water or moisture.
7. Chiefly seeds and low forms of organization.
8. As fragile drugs.
9. Powder passing through a sieve containing sixty meshes to the linear inch.
10. A dark and rough one.

# PHARMACY.

## Lecture IV.

### MUCILAGES.

A mucilage is made by a simple solution of the substance in water and straining afterward. The following are the officinal mucilages:

| | | In 100 parts. |
|---|---|---|
| Mucilage | accaciæ | 34 |
| " | cydonii (dist. water) | 2 |
| " | sassafras medullæ | 2 |
| " | tragacanthæ (glycerin 18) | 6 |
| " | ulmi (hot water) | 6 |

### SPIRITS.

An alcoholic solution of a volatile substance is termed a spirit. The officinal spirits are divided into three kinds, as follows:

1. *Natural Spirits.*

| | | | |
|---|---|---|---|
| Spirit frumenti, | containing | 50 per ct. | alcohol. |
| " vini gallici | " | 45 " | " |

For tests see U. S. P.

2. The second class consists of solutions and the aromatic spirits sometimes called "essences." These are solutions of ethereal oils in alcohol.

| | | Per cent. by weight. |
|---|---|---|
| Spiritus ætheris | | 30 |
| " " comp. | ether | 30 |
| | ethereal oil | 3 |
| " chloroformi | | 10 |
| " anisi | | 10 |
| " aurantii | | 6 |
| " camphoræ | | 10 |
| " cinnamoni | | 10 |
| " gaultheriæ | | 3 |
| " juniperi | | 3 |
| " " comp. | juuiper | 1 |
| | caraway | 0.1 |
| | fennel | 0.1 |
| " " lavandulæ | | 3 |
| " limonis, with fresh lemon peel | | 6 |
| " menthæ piperit. with green herb | | 10 |
| " " viridis | | 10 |
| " myrciæ | myrcia | 1 |
| | orange | 0.07 |
| | pimento | 0.07 |
| " myristicæ | | 3 |
| " odoratus (cologne). See U.S.P. for formula. | | |

3. *Chemical Spirits.*

| | | |
|---|---|---|
| Spiritus ætheris nitrosi (nitrous ether) | | 5 |
| " ammoniæ | | 10 |
| " aromat. | ammon. carb | 4 |
| | ammon. water | 10 |
| | oil lemon | 1.2 |
| | oil lavender | 1 |
| | oil pimento | 1 |

See U. S. P. for formula, etc.

## OLEATES.

An officinal oleate is prepared by dissolving a metallic oxide or an alkaloid in oleic acid in excess. These are different and distinct from the true solid oleates, which are supposed to be definite chemical compounds of oleic acid with various bases. The officinal oleates are:

| | In 100 parts. |
|---|---|
| Oleatum hydrargyri (yellow oxide mercury)...... | 10 |
| " veratrinæ...... .. .... ...................... | 2 |

In order to make the solution, heat to nearly 165° F., in a porcelain vessel; be careful, however, not to exceed this degree of heat; solution is then effected by trituration.

## VINA MEDICATA—MEDICATED WINE.

*Vinous* wines consist of those wines which are made with stronger white (sherry) wine.

The following are officinal:

Vinum album............... .........10 per ct. alcohol.
" " fortius..................25 " "

made by adding 15 per cent. of alcohol to sherry wine—vinum album.

Vinum rubrum.......................10 per ct alcohol.

*Medicated* wines are prepared either by extraction or solution. According to the regulations of the U. S. P. (1880), they are to be made from stronger white wine —vinum album fortius—containing by weight 20 to 25 per cent. of absolute alcohol.

| | | Per cent. |
|---|---|---|
| Vinum aloes | aloes | 6 |
| | cardamon | 1 |
| | ginger | 1 |
| " | antimonii | 4 |
| " | aromatic—absinthium, lavender, origanum, rosemary, peppermint, and sage, of each 1 part | 6 |
| " | colchici radicis | 40 |
| " | colcohici seminis | 15 |
| " | ergotæ | 15 |
| " | ferri amarum—solution citrate iron and quinine (see U. S. P. for formula) | 8 |
| " | ferri citratis—citrate iron and ammon. (for formula see U. S. P.) | 4 |
| " | ipecacuanhæ | 7 |
| " opii | opium | 10 |
| | cinnamon | 1 |
| | cloves | 1 |
| " rhei | rhubarb | 10 |
| | calamus | 1 |

## GLYCERITA—GLYCERITES.

Glycerin is a valuable solvent, and the glycerites are made by simply mixing medicinal substances with glycerin. They are also termed glyceroles.

But two are officinal:

| | In 100 parts. |
|---|---|
| Glyceritum amyli | 10 |
| " vitelli (egg yelk) | 45 |

## ELIXIRIA—ELIXIRS.

The elixirs are similar to wines or cordials, and contain small quantities of active medicinal substances.

They are made up of water, sugar, alcohol and aromatics.

Elixirs are in frequent use, but only one has been made officinal:

*Elixir aurantii*—Elixir of orange, or simple elixir, contains—

| | | |
|---|---|---|
| Oil of orange | 1 | part. |
| Sugar, granul | 100 | " |
| Alcohol | 50 | " |
| Water | 150 | " |
| To make | 300 | " |

"The oil distributed on cotton is percolated with the alcohol and water previously mixed; in the percolate the sugar is dissolved without heat and strained. With ounces (av.) for parts in this formula, the quantity of product is about two gallons. This elixir contains about 22 per cent. (vol.) alcohol."

### MISTURÆ—MIXTURES.

A mixture is an aqueous preparation containing in suspension some insoluble substance.

Most officinal mixtures quickly ferment and spoil, and should always be freshly prepared when wanted.

In order to prepare a mixture it is usual to place the intermedium—as for instance accacia—together with the medicinal substance, in a mortar and carefully triturate, the water being gradually added.

Mistura ferri ammon. acetat.—mixture of acetate of iron and ammonia—is transparent and does not hold any

insoluble substance in suspension; consequently it is misnamed. It belongs in the class of solutions.

The following are officinal:

| | | In 100 parts. |
|---|---|---|
| Mistura ammoniaci | | 4 |
| " amygdalæ... | almonds | 6 |
| | sugar | 3 |
| | accacia | 1 |
| " asafœtidæ | | 4 |
| " chloroformi | chloroform | 8 |
| | camphor | 2 |
| | egg yelk | 10 |
| " cretæ ...... | chalk powder | 20 |
| | cinnamon water | 40 |
| " ferri composita | | 2 |
| " " et ammoniæ acetatis, about | | 1 |
| " glycerrhizæ comp. | ext. glycerrhiza (pure) | 3 |
| | sugar | 3 |
| | accacia | 3 |
| | tinct. opium camph | 12 |
| | wine antimony | 6 |
| | spt. ether nit | 3 |
| " magnesiæ et asafœtidæ | magnesia carb | 5 |
| | tinct. asafœtidæ | 7 |
| | tinct. opirm | 1 |
| | sugar | 10 |
| " potassii citratis | | 10 |
| " rhei et sodæ | sodium bicarb | 3 |
| | fl. ext. rhubarb | 3 |
| | spirit peppermint | 3 |

## LINIMENTA—LINIMENTS.

Liniments are "solutions of various substances or mixtures in oily or alcoholic liquids containing fatty oils." Below we give those that are officinal:

| | | In 100 parts. |
|---|---|---|
| Linimentum | ammoniæ (in olive oil) | 30 |
| " | belladonnæ, fl. ext. with camphor | 5 |
| " | calcis (cotton seed oil) solution of | 50 |
| " | cantharides (in oil turpentine) | 15 |
| " | chloroformi (in soap liniment) | 40 |
| " | plumbi subacet. (in cotton seed oil), solution of | 40 |
| " | saponis: soap | 10 |
| | camphor | 5 |
| | oil rosemary | 1 |
| | alcohol | 70 |
| | water | |
| " | sinapis comp.: vol. oil mustard | 3 |
| | ext. mezereum | 2 |
| | camphor | 6 |
| | castor oil | 15 |
| | alcohol | |
| " | terebinthinæ, resin cerate | 65 |

ETHEREAL SOLUTIONS.

COLLODIA—*Collodions.*

Collodions are liquid solutions which have for their base collodion—a solution of pyroxylin, or gun-cotton, in a mixture of alcohol and ether. They are for external use.

The following are officinal:

| | | In 100 parts. |
|---|---|---|
| Collodium | pyroxylin | 4 |
| | stronger ether | 70 |
| | alcohol | 26 |
| " cum cantharide | cantharides (No. 60 powd.) | 60 |
| | flexible collodion | 85 |
| | commercial chloroform, sufficient quantity | |

| | | |
|---|---|---|
| Collodium flexile | collodion | 92 |
| | Canada turpentine | 5 |
| | castor oil | 3 |
| " stypticum | tannic acid | 20 |
| | alcohol | 5 |
| | stronger ether | 20 |
| | collodion | 55 |

### PRODUCTS BY EXTRACTION.

The largest classes of galenic medicine are obtained by extraction. They are vinegars, tinctures and fluid extracts ; also extracts, abstracts, resins and oleo-resins.

### ACETA—*Vinegars.*

Medicated vinegars are solutions of the active principles of vegetable drugs in acetic acid diluted with seven times its weight of water.

They are uniform in strength, each containing the soluble principles from 10 per cent. of drug, and are produced by maceration and percolation.

The following are officinal:

| | Grs. in 1 fl. oz. |
|---|---|
| Acetum lobeliæ | 45 |
| " opii | 45 |
| " sanguinariæ | 45 |
| " scillæ | 45 |

### TINCTURES.

Tinctures are alcoholic solutions holding in suspension medicinal substances, and are produced by maceration, percolation and solution or dilution.

Those obtained by *maceration* and subsequent *filtra-*

*tion* are those which contain resins and oleo-resins, musk, opium, and tinctures of fresh herbs.

They are prepared by *percolation* when produced from dried vegetable drugs, and by solution or mixing different solutions with the menstrua.

SYLLABUS OF THE OFFICINAL TINCTURES.

(Hallberg.)

| CONTAINING 10 PER CT. | Part of plant or drug. | Menstrua for 100 parts by weight. Water. | Alcohol. | |
|---|---|---|---|---|
| Tincture arnicæ rad..... | root......... | 50 | 50 | |
| " bryoniæ........ | " ......... | ...... | 100 | |
| " columbæ ...... | " ......... | 40 | 60 | |
| " chiratæ ........ | herb......... | 50 | 50 | |
| " cinnamomi... | bark ........ | 40 | 60 | |
| " croci .......... | stigma...... | 50 | 50 | |
| " cubeb .......... | fruit ........ | 50 | 50 | |
| " ignatiæ........ | seed ........ | 11 | 89 | |
| " kino............ | isp. juice ... | 17 | 68 | glycerin 15 |
| " matico......... | leaves ..... | 50 | 50 | |
| " moschi ......... | secretion ... | 50 | 50 | |
| " opii............. | isp. juice... | 50 | 50 | |
| " " deod...... | " " ... | 80 | 20 | |
| " physostigmatis............ | seed ......... | ...... | 100 | |
| " quassiæ ....... | wood ........ | 50 | 50 | |
| " serpentariæ... | rhizome .... | 50 | 50 | |
| " stramonii...... | seed ......... | 50 | 50 | |
| " sumbul......... | root.......... | ...... | 100 | |
| " tolutana ...... | balsam...... | ...... | 100 | |
| " vanillæ........ | fruit......... | 27 | 53 | sugar 20 |

| CONTAINING 5 PER CT. | Part of plant or drug. | Menstrua for 100 parts by weight. water. | Alcohol. | |
|---|---|---|---|---|
| Tinctura cantharadis... | insect........ | ...... | 100 | |
| " capsici......... | fruit......... | 5 | 95 | |
| CONTAINING 8 PER CT. | | | | |
| Tinctura iodi............ | non metal.. | ...... | 92 | |
| CONTAINING 15 PER CT. | | | | |
| Tinctura belladonnæ .. | leaves ...... | 50 | 50 | |
| " cardamomi... | fruit......... | 50 | 50 | |
| " colchici........ | seed ......... | 50 | 50 | |
| " conii .......... | fruit......... | 50 | 50 | hcl dil., 0.4 |
| " digitalis....... | herb......... | 50 | 50 | |
| " gelsemii....... | rhizome ... | ...... | 100 | |
| " hyoscyami.... | leaves....... | 50 | 50 | |
| " sanguinariæ.. | rhizome .... | 33 | 67 | |
| " scillæ.......... | bulb......... | 50 | 50 | |
| " rhei, 12 parts | root. . ...... | 50 | 50 | |
| " cardamom, 15 parts. ........ | seed ......... | ...... | dil. | |
| CONTAINING 40 PER CT. | | | | |
| Tinctura aconiti......... | tuber......... | ...... | 100 | acid tart., 4 |
| CONTAINING 50 PER CT. | | | | |
| Tinctura veratri viride | rhizome .... | ...... | 100 | |

| CONTAINING 20 PER CENT. | Part of plant or drug. | Water... | Alcohol. |
|---|---|---|---|
| Tinctura arnicæ flor | flowers | 50 | 50 |
| " asafœtidæ | gum-resin | ......... | 100 |
| " aurantii amar | rind | 50 | 50 |
| " " dulcis | rind | ......... | 100 |
| " benzoini | gum-resin | ......... | 100 |
| " calendulæ | herb | 50 | 50 |
| " cannabus ind | herb | ......... | 100 |
| " cimicifugæ | rhizome | ......... | 100 |
| " cinchonæ (glycerin) | bark | 25 | 65 |
| " gallæ (glucerin 10) | excresc. | 45 | 45 |
| " guaiac | gum-resin | ......... | 100 |
| " " ammon | gum-resin | ......... | ......... |
| (Guaiaci 20 parts in spirit amon. arom.) | | | |
| Tinctura humuli | strobiles | 50 | 50 |
| " hydrastis | rhizome | 50 | 50 |
| " krameriæ | root | 50 | 50 |
| " lobeliæ | herb | 50 | 50 |
| " myrrhæ | gum-resin | ......... | 100 |
| " nucis vomicæ (see U. S. P.) | seed | 11 | 89 |
| " pyrethri | root | ......... | 100 |
| " valerianæ | rhizome | 33 | 67 |
| " " ammon. (valerian 20 parts) (In spirit ammon. arom.) | rhizome | ......... | ......... |
| " zingiberis | rhizome | ......... | 100 |

| COMPOUND TINCTURES (*showing parts of drug by 100 in weight* | | | Water...... | Alcohol..... |
|---|---|---|---|---|
| Tinctura aloes | aloes........ ........................ | 10 | 50 | 50 |
| | ext. glycyr........................ | 10 | | |
| " aloes et myrrh | aloes......... ......... | 10 | | 100 |
| | myrrh ....... ....... | 10 | | |
| " benzoini comp. | benzoin ........... | 12 | | 100 |
| | aloes ............... | 2 | | |
| | storax ............ | 8 | | |
| | tolu............... | 4 | | |
| " cardamomi comp | cardamom......... | 2 | | 94 |
| | cinnamon ......... | 2 | | |
| | caraway............. | 1 | | |
| | cochineal.......... | 5 | | |
| | glycerin q. s....... | | | |
| " catechu comp. | catechu................ | 12 | 50 | 50 |
| | cinnamon ........... | 8 | | |
| " cinchonæ comp. | red cinchona...... | 10 | 10 | 8C |
| | bitter orange...... | 8 | | |
| | serpentrria......... | 2 | | |
| | glycerin q. s)...... | | | |
| " herbar. recentium, the fresh herb.... | | 50 | | q. s. |
| " ferri acetatis | sol. acetat. iron........ | 50 | | 30 |
| | acetic ether........ .... | 20 | | |
| " ferri chloridi, sol. iron chlor .......... | | 35 | | 65 |
| " gentianæ comp | gentian .............. | 8 | 50 | 50 |
| | bitter orange......... | 4 | | |
| | cardam .............. | 2 | | |
| " ipecac. et opii. | tinct. opii............ deod. (evap. q. s.... | 100 | | 100 |
| | fl. ext. ipecac......... | 10 | | |

| COMPOUND TINCTURES (*showing parts of drug by 100 in weight*). | | Water... | Alcohol.. |
|---|---|---|---|
| Tinctura lavendulæ comp. | oil lavender ..... 8 | | |
| | oil rosemary...... 2 | | |
| | cinnamon ......... 1.8 | | 50 |
| | cloves............... 4 | | |
| | nutmeg............ 1 | | |
| | red saunders...... 8 | | |
| " opii camphorat. | glycerin ...........q.s. | | |
| | opium p............ 4 | | |
| | ac. benz........... 4 | | |
| | camphor ........... 4 | | |
| | oil anise .......... 4 | 48 | 48 |
| " rhei aromaticæ | rhubarb ........... 20 | | |
| | cinnamon.......... 4 | | |
| | cloves............... 4 | 50 | 50 |
| | nutmeg ........... 2 | | |
| " rhei dulcis | rhubarb .................. 8 | | |
| | glycrrh.................... 4 | 50 | 50 |
| | anise ..................... 4 | | |
| | cardam ................ 1 | | |
| " saponis virid. | green soap........... 65 | | |
| | oil lavend............ 2 | | q. s. |

EXTRACTA FLUIDA—*Fluid Extracts.*

Fluid extracts are liquid alcoholic preparations that may be regarded as tinctures of uniform and known strength, prepared so as to represent the drug *volume for weight.*

Fluid extracts with one or two exceptions, cannot be prepared by simple percolation, as evaporation is nec-

essary to concentrate the percolate to the required strength.

In the U. S. P. of 1880 a cubiccentimeter represents the medicinal virtue of one gramme of the drug.

Fluid extracts are made by percolation, maceration or digestion and expression.

In percolating 100 grammes of the drug according to directions previously given (Lecture III., page 54), usually from seven to nine-tenths of the first portion of the percolate is reserved, and the remainder evaporated at a temperature not exceeding 122° F., to a soft extract, and dissolved in the reserved percolate. Enough menstruum is then added to make the fluid extract measure 100 c. c.

One grain measure of fluid extract always represents one grain of the drug from which it is produced.

There are seventy-nine officinal fluid extracts, as follows:

Menstrua—Alcohol 94 per cent vo.

| | Drug. | Percentage by weight used to moisten. | Percentage by vol. of reserve | Number of powder. |
|---|---|---|---|---|
| Ext. aromaticum fluid.......... | arom. powd | 35 | 85 | 80 |
| " aconiti " (U.S.P.) | tuber ....... | 40 | 90 | 60 |
| " belladonnæ " ...... | root.......... | 35 | 90 | 60 |
| " barycræ " ....... | flowers ...... | 40 | 90 | 40 |
| " calami " ....... | root......... | 35 | 90 | 60 |
| " cannabis ind. " ...... | herb......... | 30 | 90 | 20 |
| " capsici " ....... | fruit......... | 50 | 90 | 60 |
| " cimcifugæ " ....... | root.......... | 25 | 90 | 60 |
| " cubebæ " ....... | berry . ..... | 25 | 90 | 60 |
| " cyripedii " ....... | rhizome .... | 35 | 85 | 60 |
| " eucalypti " ....... | leaves....... | 35 | 85 | 40 |
| " gelsemii " ....... | root.......... | 30 | 90 | 60 |
| " lupulini " ....... | glands ...... | 20 | 70 | |
| " mezereii " ....... | bark ........ | 40 | 90 | 30 |
| " sabinæ " ....... | tops ........ | 25 | 90 | 40 |
| " sanguinariæ " ....... | rhizome ... | 30 | 85 | 60 |
| " scillæ " ....... | bulb......... | 20 | 75 | 20 |
| " veratri virid. " ....... | rhizome ... | 30 | 90 | 60 |
| " xanthoxyli " ....... | bark ........ | 25 | 90 | 40 |
| " zingiberis " ....... | rhizome .... | 25 | 90 | 40 |
| " ipecacuanhæ " (U.S.P.) | | 35 | | |

Menstrua—Alcohol 3 parts; water 1.

| | | | | |
|---|---|---|---|---|
| Ext. digitalis fluid ......... | leaves....... | 35 | 85 | 60 |
| " grindeliæ " ....... | herb......... | 30 | 85 | 30 |
| " guaranæ " ....... | seed ......... | 20 | 80 | 60 |
| " hydrastis " ....... | rhizome ... | 30 | 85 | 60 |

| | Drug. | Percentage by weight used to moisten. | Percentage by vol. of reserve | Number of powder. |
|---|---|---|---|---|
| Ext. hyoscyami " ........ | leaves....... | 40 | 90 | 60 |
| " irdis " ........ | rhizome ... | 40 | 90 | 60 |
| " podophylli " ........ | rhizome ... | 30 | 85 | 60 |
| " rhei " ........ | root......... | 40 | 75 | 30 |
| " serpentariæ " (U.S.P) | rhizome ... | 30 | 90 | 60 |
| " stramonii " ........ | seed.. ....... | 20 | 90 | 40 |
| Menstrua—Alcohol 8 parts; water 1. | | | | |
| Ext. nucis vomicæ fluid ........ | seed......... | 100 | 90 | 60 |
| Menstrua--Alcohol 2 parts; water 1. | | | | |
| Ext. aurantii amari fluid...... | rind ......... | 35 | 80 | 40 |
| " buchu " ...... | leaves....... | 30 | 85 | 60 |
| " colchici radicis " ...... | rhizome ... | 35 | 85 | 60 |
| " " seminis " ...... | seed.. ....... | 30 | 85 | 30 |
| " senegæ (U. S. P) " ..... | root.......... | 45 | 85 | 40 |
| " valerianæ " " ...... | rhizome ... | 30 | 85 | 60 |
| " viburni " ...... | bark ......... | 30 | 85 | 60 |
| Menstrua—Diluted alcohol; water 1 part. | | | | |
| Ext. amicæ radicis fluid........ | root ......... | 40 | 90 | 60 |
| " columbæ " ........ | root. ....... | 30 | 70 | 20 |
| " conii " ........ | fruit......... | 30 | 90 | 40 |
| " dulcamaræ " (U.S.P) | twigs ........ | 40 | 80 | 60 |
| " erythroxyli " ........ | leaves....... | 45 | 80 | 40 |
| " eupatorii " ........ | herb......... | 40 | 80 | 40 |
| " gentianæ " ........ | root.......... | 35 | 80 | 30 |
| " lobeliæ " ........ | herb......... | 35 | 85 | 60 |

| | Drug. | Percentage by weight used to moisten. | Percentage by vol. of reserve | Number of powder. |
|---|---|---|---|---|
| Ext. glycyrrhizæ " ........ | root......... | 35 | 75 | 40 |
| " pilocarpi " ........ | leaves....... | 35 | 85 | 40 |
| " quassiæ " ........ | wood......... | 40 | 90 | 60 |
| " rumicis " ....... | root. ........ | 35 | 80 | 40 |
| " spigeliæ " ........ | rhizome ... | 30 | 85 | 60 |
| " stillingæ " ........ | root......... | 30 | 85 | 40 |
| Menstrua—Alcohol 2 parts; water 3. | | | | |
| Ext. taraxaci fluid.................. | root... .... | 30 | 85 | 30 |
| Menstrua—Alcohol 3 parts; water 4. | | | | |
| Ext. sennæ fluid.................... | leaves....... | 40 | 80 | 30 |
| " ergotæ " (U. S. P.)..... | schrot....... | 30 | 85 | 60 |
| Menstrua—Alcohol 1 part; water 2. | | | | |
| Ext. frangulæ fluid.............. | bark. ........ | 35 | 80 | 40 |
| " hamamelis " ......... | leaves;...... | 35 | 85 | 40 |
| " scutellariæ " ......... | herb ........ | 35 | 80 | 40 |
| Menstrua—Alcohol and glycerin. | | | | |
| Ext. cinchonæ fluid............ | bark ........ | 35 | 75 | 60 |
| " gossypii rad. " ............ | bark ........ | 50 | 70 | 30 |
| Diluted alcohol and glycerin. | | | | |
| Ext. chimaphilæ fluid........... | leaves....... | 40 | 70 | 30 |
| " chiratæ " .. ......... | root ......... | 35 | 85 | 30 |
| " cornus " ........... | bark ........ | 30 | 85 | 60 |
| " geranii " ........... | rhizome ... | 35 | 70 | 30 |
| " krameriæ " ........... | root ........ | 40 | 70 | 30 |

| | Drug. | Percentage by weight used to moisten. | Percentage by vol of reserve | Number of powder. |
|---|---|---|---|---|
| Ext. leptandræ “ .......... | rhizome .... | 40 | 80 | 60 |
| “ pareiræ “ .......... | root ......... | 40 | 85 | 40 |
| “ rhois glabræ “ .......... | leaves....... | 35 | 80 | 40 |
| “ rosæ “ .......... | leaves....... | 40 | 75 | 30 |
| “ Uvæ ursi “ .......... | leaves....... | 35 | 70 | 30 |
| Alcohol, water and glycerin; for parts see U. S. P. | | | | |
| Ext. matico fluid....... | leaves....... | 30 | 85 | 40 |
| “ rubi “ ........ | root ......... | 35 | 70 | 60 |
| “ pruni virginianæ “ ........ | bark......... | 50 | 80 | 20 |
| “ sarsaparillæ “ ........ | root ......... | 40 | 80 | 30 |
| “ “ comp. ........ | | 40 | 80 | 30 |
| Menstrua—Boiling water. | | | | |
| Ext. tritici (U. S. P.) fluid..... | rhizome .... | ......... | ...... | cut fine |
| “ castaneæ “ ..... | leaves....... | 500 | 200 | 30 |

## EXTRACTA—*Extracts.*

Extracts, or as they are generally called, to distinguish them from fluid extracts, "solid" extracts, are simply the soluble active principles of drugs obtained by evaporating solutions of vegetable principles to a soft semi-solid consistence.

The strength of an extract depends upon the amount of the crude drug it represents. Hence, were the me-

dicinal strength of the drug uniform the percentage of the extract obtained should always bear a definite relation to the drug. Ten grains of extract are obtained from 100 grains nux vomica by the officinal menstruum. One grain of the extract represents, therefore, ten grains of the drug, and the dose of the extract is estimated accordingly.

A much greater proportion of extract, however, may be obtained by the use of a more aqueous menstruum, as with alcohol of 60 per cent, 16 grains from 100 of nux vomica. The strength of this extract is much less, as one grain represents only (100 divided by 16) 6¼ grains of the drug. If the drug is of uniform strength and the exhaustion with different menstrua complete, the quantity of extract obtained will be very irregular and correspondingly variable in strength.

The general rule is, that the more aqueous the menstruum the more extract is obtained, and the more alcoholic the menstruum the smaller the yield of extract.

In the table below we give the percentage of extracts obtained; from these the quantity of drug represented by one grain of the extract, and the dose also, may be obtained by dividing the percentage in 100, as shown above.

| | | Percentage of glycerin. | Percentage of extract from drug. |
|---|---|---|---|
| Extractum | aconiti | 5 | 20 |
| " | arnicæ radicis | 5 | ........ |
| " | belladonnæ alcoholicum | 5 | 22 |
| " | cannabis Indicæ | 5 | 10 |
| " | cinchonæ. | 5 | 16 |
| " | colocynth | ........ | 18 |
| " | conii | 5 | 25 |
| " | digitalis | 5 | 25 |
| " | ergotæ | ........ | 20 |
| " | euonymi | 5 | 20 |
| " | hyoscyami alcoholicum | ........ | 17 |
| " | iridis | ........ | 20 |
| " | jugandis | 5 | 15 |
| " | leptandræ | 5 | 18 |
| " | mezerii | ........ | 10 |
| " | nucis vomicæ | ........ | 10 |
| " | physostigmatis | ........ | 2.5 |
| " | podophylli | ........ | 10 |
| " | rhei | ........ | 35 |
| " | stramonii | ........ | 15 |
| " | aloes aquos | ........ | 50 |
| " | colchici | ........ | 35 |
| " | gentianæ | ........ | 30 |
| " | glycyrrhizæ purum | ........ | 40 |
| " | hæmatoxylon | ........ | 25 |
| " | krameriæ | ........ | 30 |
| " | malti | ........ | 65 |
| " | opii | 5 | 55 |
| " | quassiæ | 5 | .5 |
| " | taraxaci | ........ | 50 |
| " | colocynthidis comp. (see U.S.P.) | ........ | ........ |

### ABSTRACTA—*Abstracts.*

Abstracts were first introduced into the United States Pharmacopœia of 1880, and are said to have many advantages over ordinary extracts. They are obtained from the extracts by adding to them enough milk sugar to make the product represent twice its weight of the crude drug, the dose of the abstract, therefore, being one-half that of the fluid extract, and one grain of abstract represents two grains of the drug.

A properly prepared abstract is said to represent "quite as fully the medicinal strength of the drug as a powdered extract, *grain for grain*, the latter class containing inert matter in nearly as large a proportion as the abstracts. Those abstracts which contain 40 per cent. of extract, at least (20 per cent from the drug), may, therefore, be dispensed with perfect safety in place of the powdered extracts."

In order to prepare an abstract, 200 parts of the drug are exhausted in two steps, one portion being reserved, the other being evaporated and added to it. Fifty parts of sugar of milk are incorporated with the mixed liquids, and the whole allowed to dry at a temperature not exceeding 122° F. Lastly, add enough sugar of milk to make 100 parts, and reduce to a fine uniform powder.

The number of grains of abstract equivalent to one grain of the extract may be obtained by dividing the extract percentage into 50.

The following are officinal:

| | | |
|---|---|---|
| Abstractum | aconiti | 20 |
| " | belladonnæ (root) | 20 |
| " | conii (fruit) | 25 |
| " | digitalis | 25 |
| " | hyoscyami | 17 |
| " | ignatiæ | 10 |
| " | jalapæ | 17 |
| " | nucis vomicæ | 10 |
| " | podophylli | 10 |
| " | Senegæ | 35 |
| " | valerianæ | 12.5 |

### OLEORESINÆ—*Oleoresins.*

Oleoresins may be described as being semi-liquid extracts produced by extraction, ether being the menstruum used, as ether extracts, fixed and volatile oils from drugs.

The following are officinal:

*Oleoresina*—yield, 10 to 15 per cent.; *capsici*—yield, 5 per cent.; *cubebæ*—yield, 18 to 25 per cent.; *lupulini*—yield, 50 per cent.; *piperis*—yield, 5 per cent.; *zingiberis*—yield, 6 to 8 per cent.

Oleoresins belong to the ethereal liquids made by percolation, and are the strongest liquid preparations of drugs produced.

### RESINÆ—*Resins.*

Officinal resins are solid preparations and are principally the resinous principles of vegetable bodies produced by the precipitation of an alcoholic solution with

water. The precipitate, after being washed, dried and powdered, is called a resin.

As to terms *resin*, *resinoid* and *concentration*, see U. S. P. and Am. Disp.

The following are officinal:

*Resina copaibæ* (left after distilling off volatile oil); *jalapæ* (pouring a tincture into water acidulated with H C L); *scammonii* (pouring a tincture made by digesting scammony in boiling alcohol into water).

## SOLID PREPARATIONS MADE WITHOUT PERCOLATION OR MACERATION.

### PULVERES—*Powders.*

There are nine officinal powders:

| | | Parts in 100 |
|---|---|---|
| Pulvis antimonialis, James' powder. | antimony oxide | 33 |
| | calcium phosphate | 67 |
| Aromaticus | cinnamon | 35 |
| | ginger | 35 |
| | cardamom | 15 |
| | nutmeg | 15 |
| Cretæ compositus, for preparing mist cratæ. | chalk prep | 30 |
| | acacia | 20 |
| | sugar | 50 |
| Glycyrrhizæ compositus—Brust. pulver. ger. | senna | 18 |
| | glycyrrhizæ | 16 |
| | fennel | 8 |
| | sulphur, washed | 8 |
| | sugar | 50 |
| Ipecacuanhæ et opii Dover's powders. | ipecac | 10 |
| | opium | 10 |
| | milk sugar | 80 |

| | | |
|---|---|---|
| Jalapæ comp ......... | jalap ........................... | 35 |
| | potass. bitartrate ........... | 65 |
| Morphinæ comp., Tully's powder. | morphine sulph ............ | 1 |
| | camphor ........... ........ | 20 |
| | glycyrrhizæ. ................ | 20 |
| | calc carb. prec.... ......... | 20 |
| | alcohol q. s. to powd. camph. | |
| Rhei comp ........... | rhubarb ........................ | 25 |
| | magnesia ...................... | 65 |
| | ginger ......................... | 10 |
| Effervescens comp.. Seidlitz powders, | sod. bicarb ................. | 480 grs. |
| | roch. salts.... ................ | 1440 grs. |
| | tart. acid ...... ............... | 420 grs. |

Mix sod. bicarb. and Rochelle salts; divide into 12 equal parts—blue papers; divide acid into 12 equal parts—white papers.

## TRITURATONES—*Triturations.*

Triturations are also called "diluted" powders, as hey are produced by diluting powders with milk sugar. —(See U. S. P.)

The following is officinal:

### TRITURATIO ELATERINI, U. S.

Elaterin, 10 parts, or ................................ 6 grs.
Sugar of milk, in moderately fine powder,
90 parts, or ....................................... 54 grs.

—

To make 100 parts, or ........................... 60 grs.

Mix them thoroughly by trituration.

## MASSÆ—*Masses.*

Masses are obtained, (1) by incorporating the drug with adhesive substances; (2) by chemical reaction; (3) sometimes by both.

By the first process:

| | | |
|---|---|---|
| Massa hydrargyri, (blue mass) | mercury | 33 |
| | glycyrrhiza | 5 |
| | althæa | 25 |
| | honey of rose | 34 |
| | glycerin | 3 |

By second process:

| | | |
|---|---|---|
| Massa copaibæ | copaiba | 94 |
| | magnesia | 6 |

By both above processes:

| | | |
|---|---|---|
| Massi ferri-carbonatis—Vallet's mass | iron sulph | 100 |
| | sodium carb | 110 |
| | honey | 38 |
| | sugar | 25 |
| | syrup and water to make | 100 |

CONFECTIONES—*Confections.*

Under the old names of *conserves* and *electuaries* confections have been in use for centuries.

There are two officinal confections:

| | | |
|---|---|---|
| Confectis rosæ, conserve of roses. | red rose | 8 |
| | rose water | 16 |
| | sugar | 64 |
| | honey | 12 |
| Confectio sennæ | senna | 10 |
| | coriander | 6 |
| | cassia fistula | 16 |
| | fig | 12 |
| | tamarind | 10 |
| | prune | 7 |
| | sugar | 50 |
| | water to make | 100 |

## TROCHISCI—*Troches.*

Troches consist chiefly of medicinal powders, sugar and mucilage. For their manufacture see Remington's Pharmacy, page 957, as they are seldom prepared in the pharmacy.

Lozenges of peppermint, lemon, musk, vanilla and wintergreen may be made by saturating pure sugar lozenges with the respective essences or tinctures. As they are generally made on a large scale and by machinery, we simply name them here.

There are sixteen officinal lozenges:

Trochisci acidi tannici, ammonii chloridi, catechu, cretæ, cubebæ, ferri, glycyrrhizæ et opii (1.20 grain ext. opium in each), ipecacuanhæ, krameriæ, magnesiæ, menthæ piperitæ, morphinæ et ipecacuanhæ (1-20 grain sulph. morph. in each), potassii chloratis, sodii bicarbonatis, sodii santoninatis, zingiberis.

## PILUTÆ—*Pills.*

Pills are rotund masses of medicinal substances rendered cohesive by the addition of some adhesive and usually inert substance, which is called an *excipient.* The excipient must always be indifferent in character to avoid change in the medicinal substances, unless the physician direct to the contrary.

Always weigh your pill mass after mixing it, and see that it corresponds with the total mass of the ingredients, and where no excipient is ordered select the

simplest and the one which will least increase the size of the pill; the mass must be adhesive, firm and plastic.

### LIQUID EXCIPIENTS.

(Stewart.)

1. Water; use only when ingredients possess inherent adhesiveness that it will develop.
2. Syrup; adhesive.
3. Syrup acacia; more adhesive.
4. Mucilage acacia; most adhesive. Pills are liable to become hard and insoluble if acacia in any form is used as excipient.
5. Glycerin; somewhat adhesive. It is hygroscopic and keeps pills soft.
6. Glucose; very adhesive, colorless and non-volatile at ordinary temperatures; very valuable.
7. Honey; good substitute for glucose, but colors white pills.
8. Extract of malt; advantages of glucose, but disadvantage (color) of honey.
9. Glycerite of starch—glycerin; adhesiveness of starch and jelly; thickness sometimes an objectionable feature.
10. Glycerite of tragacanth; similar to above.
11. Remington's general excipient. (See Remington's Treatise on Pharmacy.)

### SOLID EXCIPIENTS.

1. Confection of rose; useful when it is desired to dilute active ingredients and increase bulk.

2. Bread crumb; used in making pills to contain croton oil, volatile oils, etc.

3. Powdered althæa; too bulky for ordinary use.

4. Soap; valuable for resinous substances; not only makes excellent mass, but increases the solubility of resins.

5. Resin cerate; for oxidizable substances, resins, etc.

6. Cacao butter; for pills of permanganate of potassium, etc.

7. Petrolatum; for oxidizable substances, as above.

The mass may be divided into two parts: (1) the active ingredients, and (2) the excipient.

In making pills, solid substances must first be reduced to a very fine powder and well mixed with a small portion of the diluent or excipient; when the remainder of the excipient is added, the consistency of the mass should be such that it will scarcely adhere to the side of the mortar; in the case of a good pill mass the mortar will present an almost clean appearance when the operation is finished.

In rolling out the mass see that when rolled into a cylinder it is of uniform diameter and parallel ends; roll it so that it will evenly fit into the graduated measure on the pill tile; round with a slab or similar device which is called a *muller;* meanwhile using dusting powder (glycyrrhizæ or lycopodium is the best) to keep the pills separate. (For a description of pill coating and pill machines the student is referred to Prof. Remington's Treatise on Pharmacy.)

The following are officinal:

| | | Grs. of active drug in each pill. |
|---|---|---|
| Pilulæ aloes | | 2 |
| Aloes et asafœtidæ (of each) | | $1\frac{1}{3}$ |
| " et ferri " | | 1 |
| " et mastiches | aloes | 2 |
| | mastich | $\frac{1}{2}$ |
| " et myrrhæ | aloes | 2 |
| | myrrh | 1 |
| Antimonii comp. | antimon. sulph | $\frac{1}{2}$ |
| | calomel | $\frac{1}{2}$ |
| | guaiac | 1 |
| Asafœtidæ | | 1 |
| Cathartic comp. | ext. colocynth comp. | 1.3 |
| | abstract jalap | 1 |
| | calomel | 1 |
| | gamboge | $\frac{1}{4}$ |
| Ferri comp. | myrrh | $1\frac{1}{2}$ |
| | iron carb | 1 |
| Ferri iodidi | | 1 |
| Galbani comp. | galbanum | $1\frac{1}{2}$ |
| | myrrh | $1\frac{1}{2}$ |
| | asafœtida | |
| Opii | | 1 |
| Phosphori | | .01 |
| Rhei | | 3 |
| Rhei comp. | rhubarb | 2 |
| | aloes | $1\frac{1}{2}$ |
| | myrrh | 1 |
| | oil peppermint | 1 |

## UNGUENTA—*Ointments.*

The base of ointments consists of fatty substances, and care must be had to see that the medicinal substances are thoroughly distributed throughout the ve-

hicle lest they prove irritating, and a *smooth* product should be insisted upon.

Their melting point is governed by that of the vehicles used, which is either directed by the physician or the Pharmacopœia.

Ointments are prepared (1) by mechanical admixture; (2) by the use of heat; (3) by chemical reaction.

In the first case the substances are simply rubbed together in a mortar or on a pill tile. Solid substances must be reduced to very fine powder; a small portion of the fat is then thoroughly mixed with the powders, and then the remainder of the vehicle must be thoroughly incorporated with them.

Extracts, especially when hard, may be softened by adding (according to the solvent used in their extraction) a small portion of water, alcohol or glycerin to them.

When using heavy, dry powders, their agglomeration may be prevented by triturating them with a small portion of the fat previously melted in a warm mortar.

The following officinal ointments are prepared by simple admixture:

| | Base. | Parts of drug in 100. |
|---|---|---|
| Unguentum acidi carbolici............ | ointment......... | 10 |
| " acidi gallici................ | benz. lard........ | 10 |
| " chrysarobini (U. S. P.) | " " ....... | 10 |
| " belladonnæ ............... | " " ....... | 10 |
| " gallæ........................ | " " ....... | 10 |
| " hydrargyri ammoniate | " " ....... | 10 |
| " " oxidi flavi | " " ....... | 10 |
| " " rubri......... | " " ....... | 10 |
| " iodi (potass. iod., 1; water 2 parts)........... | " " ....... | 4 |
| " iodoformi ................. | " " ....... | 10 |
| " plumbi carbonatis ...... | " " ....... | 10 |
| " " iodidi ............ | " " ....... | 10 |
| " potassii iodidi (sodii hyposulph. 1 part)..... | " " ....... | 12 |
| " stramonii.................. | " " ....... | 10 |
| " sulphuris ................. | " " ....... | 30 |
| " " alkal. (potass. carb., 10)................ | " " ....... | 20 |
| " eratrinæ (alcohol, 6).... | " " ....... | 4 |
| " inci oxidi...... ........... | " " ....... | 20 |

When prepared by heat, when completely melted the mixture is strained and then stirred until cold.

The following are officinal;

| | | In 100 parts. |
|---|---|---|
| Unguentum | lard | 80 |
| | wax | 20 |
| " aqua rosæ | oil almonds, exp. | 50 |
| | spermaceti | 10 |
| | white wax | 10 |
| | rose water | 30 |
| " diachylon | lead plaster | 60 |
| | olive oil | 39 |
| | oil lavender | 1 |
| " mezerei | fl. ext. mezereum | 25 |
| | lard | 80 |
| | wax | 12 |
| " pices liquiæ | tar | 50 |
| | suet | 50 |

In ointments prepared by chemical reaction the character of the medicinal substance, and sometimes that of the vehicle also, are changed. In the case of the mercuric nitrate ointment, the nitric acid acting on the mercury forms mercuric nitrate, while the excess of acid oxidizes the lard and forms a new compound—elaidine.

Two of these are officinal:

| | | In 100 parts. |
|---|---|---|
| Unguentum hydrargyri. | mercury | 45 |
| | lard | 22.5 |
| | suet | 22.5 |
| | tr. benz. comp | 4 |
| | mercurial ointment | 10 |
| " hydrargyri nitratis (see U. S. P.) | mercury | 7 |
| | acid nitric | 17 |
| | lard oil | 76 |

## Questions to Lecture IV.

1. How is a mucilage made?
2. In collodion flexile how many parts of collodion?
3. How are the largest classes of galenic medicine obtained?
4. What part of the drug is used in making tinctura vanillæ?
5. Upon what does the strength of an extract depend?
6. What does one grain of an extract represent?
7. How many powders are officinal?
8. When should water be used as an excipient in making pills?
9. How much opium in pilulæ opii?
10. What is the base of ointments?

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## Answers to Questions on Lecture III.

1. A greater degree of heat is obtained.
2. One will attract moisture and pass into a liquid state; the other attracts moisture also, but owingto its inferior solubility does not become liquid.
3. Water, unless some other solvent be mentioned.
4. Molecular attraction.
5. A coarse powder.
6. The use of moderate heat in maceration.
7. For the preparation of tinctures, fluid extracts, etc.

8. Solutions—those in which no chemical change occurs.

9. According to the direction of the general officinal formula in the U. S. P.

10. A decoction is prepared by boiling, an infusion is not—hot or cold water being used in preparing infusions.

# PHARMACY.

## Lecture V.

### SUPPOSITORIA—*Suppositories.*

Suppositories are solid cone-shaped bodies, consisting of medicated fats, and having for a base cacao butter (oleum theobromæ). They should retain their shape at ordinary temperatures, but readily melt or soften at the temperature of the body; the addition of wax, spermaceti, etc., is sometimes necessary to raise the melting point of the suppository.

Moulds are usually employed in preparing them; those made of plaster paris, paper, etc., are also employed. The solid medicinal substances must first be powdered; then mix with a small portion of the oil; thoroughly incorporate this mixture with the remainder of the oil previously fused and cooled to 95° F.; then, if possible, without further heating, pour into the moulds previously chilled. "A more exact method," it is claimed, "is to weigh out the mass after cooling and shape each suppository with the fingers."

The U. S. P., '80, gives no officinal formulas for suppositories, but gives the process, and directs that when

not otherwise specified, the weight of a suppository shall be 15 grains (1 gram).

### EMPLASTRA—*Plasters.*

Plasters are compounds of various substances of such consistence that they adhere to the skin. They are usually spread on muslin, leather, paper, etc.; the aid of heat is required in spreading them, and care must be had lest it be too great or be continued too long. They may be easily spread by using the plaster iron. (For apparatus, etc., see Remington's Pharmacy and U. S. Disp.) They have as a basis lead plaster, a gum resin, or Burgundy pitch.

The following are officinal:

(1) Simple plasters:

| | | In 100 parts. |
|---|---|---|
| Emplastrum ammoniaci | (dil. acetic acid, 140 parts | 100 |
| " ichthyocollæ (court plaster), see U. S. P. | | |
| " picis burgundicæ | Burgundy pitch | 90 |
| | wax | 10 |
| " picis canadensis. | Canada pitch | 90 |
| | wax | 10 |
| " plumbi. | lead oxide | 32 |
| | olive oil | 60 |
| | water q. s. | |

(2) Compound plasters:

| | | |
|---|---|---|
| Emplastrum ammoniaci cum hydrargyr. | ammoniac | 72 |
| | mercury | 18 |
| | olive oil | 8 |
| | sulphur | 1 |
| | dil. acetic acid | |
| | lead plaster q. s. | |
| " arnicæ. | extract arnica root | 5 |
| | resin plaster | 100 |

| | | |
|---|---|---|
| Emplastrum asafœtidæ. | asafœtida | 35 |
| | lead plaster | 35 |
| | galbanum | 15 |
| | wax | 15 |
| | alcohol q. s. | |
| " belladonna | ext. belladonna root | 10 |
| | resin plaster | 90 |
| " capsici | oleo resin capsicum q. s. | |
| | resin plaster q. s. | |
| " ferri | hydrated iron oxide | 10 |
| | Canada turpentine | 10 |
| | Burgundy pitch | 10 |
| | lead plaster | 70 |
| " galbani | galbanum | 96 |
| | turpentine | 2 |
| | Burgundy pitch | 6 |
| | lead plaster | 76 |
| " Hydrargyri | mercury | 30 |
| | olive oil | 10 |
| | resin | 10 |
| | lead plaster | 50 |
| " opii | extract opium | 6 |
| | Burgundy pitch | 18 |
| | lead plaster | 76 |
| | water q. s. | |
| " picis cum cantharide | cerate cantharides | 8 |
| | Burgundy pitch | 92 |
| " resinæ | resin | 14 |
| | wax | 6 |
| | lead plaster | 80 |
| " saponis | soap | 10 |
| | lead plaster | 90 |

## CERATA—*Cerates.*

Cerates are generally prepared with oil, lard or petroleum for a basis, with enough wax (cera) to give the

desired firmness. They are prepared either by fusion or by incorporation. Below are those officinal:

(1) Prepared by fusion:

| | | In 100 parts. |
|---|---|---|
| Ceratum | white wax | 30 |
| | lard | 70 |
| " cantharidis. | cantharides | 35 |
| | wax | 20 |
| | resin | 20 |
| | lard | 25 |
| " cetacei | spermaceti | 10 |
| | white wax | 35 |
| | olive oil | 55 |
| " extracti cantharidis. | cantharides | 30 |
| | alcohol q. s. | |
| | resin | 15 |
| | wax | 35 |
| | lard | 35 |
| " resinæ | resin | 35 |
| | wax | 15 |
| | lard | 50 |
| " sabinæ | fluid extract sabine | 25 |
| | resin cerate | 90 |

(2) Made by incorporation:

| | | |
|---|---|---|
| Ceratum camphoræ | camphor linim | 3 |
| | olive oil | 12 |
| | cerate | 85 |
| " plumbi sub acetatis. | sol. lead subacetate | 20 |
| | camphor cerate | 80 |

## CHARTA—*Papers.*

Papers consist of a small class of preparations made by saturating paper with medicinal substances, or by

applying them to the surface of the paper by means of some adhesive liquid.

There are three officinal papers:

| | | |
|---|---|---|
| Charta cantharidis | white wax | 8 |
| | spermaceti | 3 |
| | olive oil | 4 |
| | Canada turpentine | 1 |
| | cantharides | 1 |
| | water | 10 |
| " potassi nitratis | nitrate of potassium | 20 |
| | distilled water | 80 |
| Charta sinapis | black mustard | |
| | benzin | |
| | solution of gutta percha, of each q. s. | |

THE ORGANIC ACIDS.

The organic acids possess characteristic properties that distinguish them as a class, and are found in nature free and in combination. They all contain oxygen and are destitute of nitrogen in their composition; hydrocyanic acid, however, is an exception to the rule, and in its chemical relations bears a close resemblance to the inorganic hydro acids. They are built on the type of the water molecule, and consequently may be monobasic, dibasic, tribasic, etc., according as they have one or more replaceable hydrogen atoms.

"An organic acid differs structurally from an inorganic acid in having one of the hydrogen atoms of the water molecule replaced by an organic compound radical instead of an inorganic radical."

Like the inorganic acids they form salts with the metals.

As a whole they are less stable than the inorganic acids, their instability increasing with the complexity of their molecules.

Only the acids of importance to pharmacy will be described here. These are: Acetic, carbolic, gallic, oleic, salicylic, benzoic, citric, lactic, oxalic, tannic and tartaric.

ACETIC ACID—$HC_2 H_3 O_2$—*Monobasic.*

The chief source of acetic acid is from the distillation of wood. After this process the wood remains in the retort as charcoal, while a part of the product, consisting of tarry matters, creosote, oils, an aqueous solution of acetic acid, methyl alcohol, etc., condenses in the receiver, and a part, consisting of condensable gases, is conducted off and used for fuel.

The best acetic acid for pharmaceutical and medical purposes, however, is made by carefully heating small billets of oak wood, the temperature required for its production being much less than that required to produce charcoal. It is also made by distilling *vinegar,* a liquor produced by the oxidation of dilute alcoholic liquors, such as cider, wine, etc.

Absolute acetic acid is a clear, colorless liquid, with a purely acid taste and reaction. It boils at 214.5° F., and crystallizes at 62° F.

Three strengths of this acid are officinal:

*Acidum Aceticum*—36 per cent. acid and 64 per cent. water.

*Acidum Aceticum Dilutum*—Water, 83 parts; acetic acid, 17 parts.

*Acidum Aceticum Glaciale*—Made by heating sodium acetate until the water of crystallization is driven off, and after powdering, distilling the residue with concentrated sulphuric acid.

Officinal acetates and preparation of acetates are:

| | |
|---|---|
| Plumbi acetas, | Zinci acetas, |
| Potassii acetas, | Morphinæ acetas, |
| Sodii acetas, | Ammonii acetas. |

### BENZOIC ACID—$HC_7\ H_5\ O_2$—*Monobasic.*

Benzoic acid is found natural in benzoin (from which it is obtained by sublimation) and balsam of tolu, etc. It is obtained artificially from the urine of cattle, from napthalin, etc.

*Description*—White, lustrous scales or friable needles permanent in air, slight aromatic odor of benzoin, acid taste and reaction, and is soluble in 500 parts of water at 59° F., and in 15 parts of boiling water.

Officinal preparations:

Ammonii Benzoas, Sodii Benzoas, Adeps Benzoinatus, Lithii Benzoas, Tinct. Opii Camph.

### CARBOLIC ACID, OR PHENOL—$C_6\ H_5\ HO$.

Carbolic acid is obtained by distilling that part of coal tar known as "dead oil," and collecting what comes over between the temperatures of 302° and 392° F. This, after proper rectification, constitutes the

*crude* carbolic acid of the U. S. P. From this the pure is obtained on further treatment in the shape of colorless, interlaced, needle-shaped crystals.

It will remain permanently fluid if the crystals be melted by immersing the bottle containing them in hot water and then mixing them in the proportion of one part of water to nineteen of the acid.

Officinal preparations:

*Acidum Carbolicum*, a nearly colorless or reddish brown liquid containing carbolic and cresylic acids in variable proportions, and other substances.

*Acidum Carbolicum*, the pure form described above.

*Unguentum Acidi Carbolici.*

### CITRIC ACID—$C_6 H_8 O_7 + H_2 O$.

Citric acid is a tribasic acid, and belongs to the series of fruit acids, being derived chiefly from lemons and limes. It is obtained in colorless right rhombic prisms, not deliquescent except in moist air, efflorescent in warm air, and odorless. For tests of purity see U. S. P.

Officinal preparations:

Bismuthi citras, lithii citras, potassii citras, liquor ferri citratis, liquor magnesii citratis, liquor potassii citratis, syrupus acidi citritis.

Some of these may be found in the following preparations: Bismuthi et ammonii citras, ferri citras, ferri et ammonii citras, ferri et quininæ citras, and ferri et strychninæ citras.

The U. S. P. directs that in drying compounds of iron and citric acid the temperature be not raised above 140° F., as they readily decompose if heated to a higher degree.

GALLIC ACID—$C_7 H_6 O_5 + H_2 O$.

Gallic acid is a monobasic acid; its principal source is nutgalls; it is also found in uva ursa, sumac, etc.

*Preparation.*—Prepared by macerating finely powdered nutgalls made into a paste with water for a month in a warm, moist place, and expressing and rejecting the expressed liquid; then boil the residue in water, and filter while hot through animal charcoal, and crystallize.

In this process the tannic acid of the galls is converted into gallic acid by the continued maceration with the galls. This acid when sublimed is converted by the heat into pyrogallic acid and carbon dioxide.

*Character.*—A nearly or quite colorless solid, crystallizing from water in long silky needles or triclinic prisms, permanent in air, odorless, slightly acidulous taste and acid reaction; soluble in 100 parts of cold and 3 of boiling water at 59° F.; soluble in 2.6 parts of absolute alcohol. For tests of purity see U. S. P.

The only officinal preparation is unguentum acidi gallici.

TANNIC ACID—$C_{14} H_{10} O_9$—*Tribasic.*

*Character.*--Light yellowish scales, permanent in air; faint, peculiar odor; strongly astringent taste; acid reaction.

*Preparation.*—It is obtained from galls by means of water and ether, and after proper expression driving off the solvents by exposing the extract to a temperature a little below the boiling point of water. It is soluble in 6 parts of water, or of alcohol, at 59° F. Chemically it is an anhydride of gallic acid.

All varieties of this acid agree in producing dark colored precipitates with salts of iron and in precipitating gelatin from its solution.

When preparing it should not be allowed to come in contact with iron lest the product be blackened.

Officinal preparations:

Collodium stypticum, trochisci acidi tannici, unguentum acidi tannici.

### LACTIC ACID—$C_3 H_6 O_3$—*Monobasic.*

Lactic acid is formed in milk when it sours by the fermentation of the sugar of milk, and is obtained in other ways. It is a nearly colorless liquid, odorless, very acid taste and acid reaction.

One of the simplest methods for preparing it is to mix 25 parts of milk sugar, 20 parts of chalk, 100 parts of skimmed milk and 200 of water, and digest at a temperature of about 75° F. for six weeks, until the chalk has passed into solution; then elevating the temperature to a little below the boiling point, the cheese is skimmed off and the liquid clarified by means of albumen and concentrated to crystallize the lactate of lime. The crystals are purified by recrystallization and the

lactic acid set free by treating them with just a sufficient quantity of sulphuric acid. The lactic acid of the U. S. P. contains 75 per cent. of absolute acid and 25 per cent. of water. It is miscible in all proportions with water, alcohol and ether.

Officinal preparations:

Ferri lactas, syrupus calcii lactophosphatis.

OLEIC ACID—$C_{18}H_{34}O_2$—*Monobasic.*

*Character.*—A yellowish oily liquid, gradually becoming brown, rancid and acid when exposed to air; nearly odorless when pure; of a neutral reaction. It is obtained as a by-product in the manufacture of candles from fats. When pure it is colorless. It is insoluble in water, but freely soluble in alcohol and ether.

Officinal preparations:

Oleatum hydrargyri, oleatum veratrinæ.

*Red oil* is crude oleic acid.

OXALIC ACID—$H_2C_2O_4+2H_2O$.—*Dibasic.*

Oxalic acid is of frequent occurrence in the vegetable kingdom, occurring as acid potassium oxalate in sorrel and other plants; also in combination with lime, which combination is often found in the human body.

*Character.*—Soluble in 8 parts of cold and in all proportions in boiling water. Small colorless prismatic crystals; odorless, with a very sour taste. Made by acting on cellulin, sugar or starch with nitric acid. The pure acid will not blacken when heated on pla-

tinum foil, but melts at about 208° F. The crystals are poisonous, and the proper antidote is chalk or magnesia.

Officinal preparations:

Cerii oxalas, ferri oxalas. The acid itself is not officinal, but its volumetric solution is given in the U. S. P.

SALICYLIC ACID—$C_7 H_6 O_3$—*Monobasic.*

*Character.*—Fine, white, light, prismatic, needle-shaped crystals, permanent in air; free from odor of carbolic acid; acid reaction, and having, sometimes, an aromatic odor. It occurs in combination in the vegetable kingdom.

It may be prepared by heating oil of wintergreen with a strong solution of caustic potassa, as long as methylic alcohol is given off, and treating the potassium salicylate thus formed with chlorohydric acid, which combines with the potassium, setting free the salicylic acid. It is prepared commercially from carbolic acid. For tests see U. S. P.

Officinal preparations:

Lithii salicylas, physostigminæ salicylas, sodii salicylas.

TARTARIC ACID—$C_4 H_6 O_6$—*Dibasic.*

This acid is free or in combination in the juices of many fruits, as grapes, sumac berries, etc. Its principal commercial source is from cream of tartar, which is derived from the crude tartar, or argol, that collects in crusts on the sides of casks of fermenting wines.

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*Character.*—Colorless crystals of oblique rhombic prisms, permanent in air; odorless; acid taste and reaction; soluble in 7 parts of water at 59° F., and in 2.5 parts of alcohol or 3.6 parts of absolute alcohol at the same temperature.

Officinal preparations:

Antimonii et potassii tartras, ferri et ammonii tartras, ferri et potassii tartras, potassii bitartras, potassii et sodii tartras.

There are a host of other organic acids, but as none of them are officinal or of especial importance to pharmacy, none of them will be described here.

### THE ALCOHOLS.

*Alcohol* is a term used to designate a class of carbon compounds. Alcohols are hydrates of the radicals *ethyl*, *amyl*, etc. As they may be either monotomic, diatomic or triatomic, they give rise to several distinct series of alcohols. The alcohols are characterized: (1) By being neutral to test paper; (2) decomposable by action of acids into ethers and water; (3) convertible by the withdrawal of a portion of their hydrogen into aldehydes. The alcohols most important to pharmacy are: Methyl alcohol, ethyl alcohol, amyl alcohol, and propenyl alcohol or glycerin.

### METHYL ALCOHOL AND ITS DERIVATIVES.

*Methyl alcohol* $(C\ H_3)\ HO$, is obtained by the dry distillation of wood, this being its principal commercial source. It is known generally as "wood spirit."

*Character.*—A colorless, volatile liquid; warm alcoholic taste, and boils at 149° F. It is not officinal and is little used in medicine.

*Methylated spirit*, a term we sometimes see used, is common alcohol mixed with 10 per cent. of *methyl* alcohol.

*Ethyl alcohol* ($C_2 H_6 O$), *or Alcohol.*—This alcohol is obtained by successive distillations and rectifications of various kinds of spirituous liquors.

*Absolute alcohol* is a colorless liquid with feeble odor. Potassium permanganate is insoluble in it and imparts no color to it, but if it contain only 5 per cent. of water it will become tinged by it.

Alcohol (U. S.) contains 91 per cent. by *weight* of absolute (ethyl) alcohol; 94 per cent. by *volume;* sp. gr. at 60° F., .820. Usually obtained by distilling whisky, redistilling and rectifying.

*Alcohol dilutum* (U. S.), diluted alcohol, is a mixture of equal parts by *weight* of alcohol and water. It therefore contains 45.5 per cent. by *weight*, or 53 per cent. by *volume*, of absolute alcohol; sp. gr. at 60° F., .928. Its chief use in pharmacy is as a menstruum for tinctures.

One rule for preparing diluted alcohol from alcohol of any higher percentage is to divide the alcoholic percentage of the alcohol to be diluted by 45.5 and subtract 1 from the quotient. This gives the number of parts of water to be added to 1 part of the alcohol. All terms denote weight in this rule. In mixing alcohol

and water a contraction of volume occurs; for instance, 55 gallons of alcohol + 45 gallons of water equals 96¼ gallons—a loss of 3¾.

Below we give the number of parts and per cent. of absolute alcohol in the proof spirits according to the standard of the United States Custom-house:

Proof spirit (sp. gr. .936 at 60° F.) *equal parts by volume* of absolute alcohol and water.

| | Per ct. absolute alcohol. |
|---|---|
| Second proof (sp. gr. .931) | 52½ |
| Third proof (sp. gr. .925) | 55½ |
| Fourth proof (sp. gr. .920) | 58 |

Spirits stronger than these are said to be *over* proof.

*Whisky* (*spiritus frumenti*, U. S. P.)—Usually prepared by distilling a fermented infusion of a mixture of Indian corn and rye. The fermenting mixture is called "Mash," and the weak spirit that is the product of the first distillation is known as *low wine.* The U. S. P. requires that whisky be at least two years old, of an amber color, sp. gr. not above .930 nor below .917, and of an alcoholic strength of not less than 44 per cent., nor more than 50 per cent.

*Brandy* (*spiritus vini gallici*, U. S. P.)—Obtained by distilling fermented grapes. The U. S. P. directs that it shall be at least four years old.

## WINES.

Wines are obtained by the fermentation of fruit juices, mainly those of the various grapes. They are

divided into *white* or light colored and *red* wines. The former are produced by the fermentation of the expressed juice alone without the pericarp.

*Vinum album*, U. S. P., refers to no particular white wine, but to any one having the required strength and purity. It should have a full fruity taste; odor free from yeastiness, and contain not less than 10 per cent., nor more than 12½ per cent. of absolute alcohol. Sherry and Madeira are examples of this wine. The stronger white wine of the U. S. P. (wine, 7 parts; alcohol, 1) should contain not less than 20 nor more than 25 per cent. of absolute alcohol.

*Vinum rubrum*, U. S. P., refers to no particular species of red wine, requirements being as in case of white wine. Claret and port are examples of this wine.

AMYL ALCOHOL, OR FUSEL OIL—$C_5 H_{12} O$.

Its sources have already been described.

*Character.*—A thin, oily liquid; oppressive, penetrating odor, and acrid, hot taste. It is used as a solvent for some of the alkalis, source of valerianic acid and of various compound ethers.

PROPENYL ALCOHOL, OR GLYCERIN—$C_3 H_5 (HO)_3$.

Glycerin is a sweet principle derived from fats and fixed oils.

Glycerinum (U. S.) is a clear, colorless liquid, of syrupy consistence, oily to the touch, and containing not less than 95 per cent. of absolute glycerin. Like the other alcohols, it is combustible, burning with a bluish, non-luminous flame.

*Nitro-glycerin* is regarded as one of its ethereal salts. It is obtained by dipping glycerin into a mixture of nitric and sulphuric acids in a vessel immersed in a freezing mixture. The product, an oily liquid, is purified by washing in water. Mixed with some inert matter, like infusorial earth, it constitutes dynamite.

### THE ETHERS.

The ethers are the product of the action of acids upon the alcohols, and as alcohols are arranged into a series, so there is also a series of ethers.

The alcohols are *the hydrates of the alcohol radicals* (ethyl hydrate, alcohol; amyl hydrate, amylic alcohol), just as slaked lime, or calcium hydrate, is the hydrate of the metal calcium.

Ethers are the *oxides of these radicals*, just as lime, or calcium oxide, is the oxide of the metal calcium.

*Methylic ether* $(C H_3)_2 O$, is a volatile, colorless, inflammable liquid at the temperature of 5.8° F., but at higher temperatures a gas that is freely soluble in water, alcohol, etc.; use in pharmacy limited. It is prepared by distilling methylic alcohol with sulphuric acid.

The student is here cautioned to be particular when pouring the ethers from one vessel to another by gaslight, as their vapors, heavier than air, will readily burn with explosive force on contact with the flame.

*Ethyl or Sulphuric Ether* $(C_2 H_5)_2 O$.—A product of the distillation of ordinary alcohol with sulphuric acid.

*Character.*—A colorless, volatile and inflammable liquid.

It should be handled with care, as the vapors arising from it on mixing with the air become explosive.

*Æther fortior*—stronger ether—U. S. P., consists of 94 per cent. of absolute ether with 6 per cent. of alcohol and a little water. This preparation should be carefully kept from light and fire.

*Ether* (U. S.) consists of about 74 per cent. of absolute ether, the remainder being alcohol with a small portion of water.

*Spirit of Ether* (U. S.) is simply a mixture containing 30 parts of the officinal ether to 70 of alcohol.

*Compound Spirit of Ether* (U. S.), known as Hoffman's anodyne, is also a mixture of 30 parts of stronger ether to 67 of alcohol and three of ethereal oil.

*Ethyl Chloride* $(C_2 H_5)$ Cl., *or Chlorhydric Ether.*—Obtained by the action of phosphorus pentachloride on ordinary alcohol. It is a colorless, volatile and inflammable liquid.

*Ethylene Bi-Chloride* $(C_2 H_4) Cl_2$—Known also as "Dutch liquid." It is the product of the reaction of chlorine gas upon olefiant gas, and is a thin, colorless, oily liquid and inflammable.

*Ethyl Bromide* $(C_2 H_5)$ Br., *or Bromohydric Ether.*—It somewhat resembles ethyl chloride in its physical properties, but is denser and less readily inflammable.

It is produced by the reaction of bromine on alcohol in the presence of phosphorus.

"*Ethyl Iodide, or Iodohydric Ether*, is prepared by a method analagous to that adopted in the preparation of ethyl bromide. It is a volatile, colorless, non-inflammable liquid."

*Nitrous Ether* $(C_2 H_5) (N O) O.$, *or Ethyl Nitrate.*—This is formed with other products when alcohol is acted upon by nitric acid. It is a colorless liquid, having an odor resembling apples.

*Sweet Spirits of Nitre*, or Spirit of Nitrous Ether, is a clear, volatile, inflammable liquid, of a pale straw color, inclining slightly to green. It is prepared by distilling a mixture of alcohol, sulphuric acid and nitric acid together.

*Acetic Ether* $(C_2 H_5) (C_2 H_3 O)$, *or Ethyl Acetate.*—Prepared by distilling sodium acetate, alcohol and sulphuric acid together, shaking the distillate with exsiccated sodium acetate and redistilling it. It is transparent and colorless and of neutral reaction.

## COMPOUNDS RELATED TO THE ALCOHOLS AND ETHERS.

*Chloroform* $(C H) Cl_3$.—This is one of the most important of compounds related to the alcohols and ethers.

*Chloroformum Venale*, commercial chloroform, is a liquid consisting of at least 98 per cent. of chloroform, and is produced by distilling chlorinated lime with alcohol. It may also be produced by the action of an alkali on chloral hydrate.

*Chloroformum Purificatum* (U. S.)—Purified chloroform, $C H Cl_3$; a clear, colorless, diffusive liquid, sp.

gr. 1.485; neutral reaction. It is obtained by purifying commercial chloroform with sulphuric acid, carbonate of sodium, alcohol and lime, and distilling. It is said to be less safe as an anæsthetic than ether; it is also claimed that most of the accidents that happen from its proper use as an anæsthetic are attributable to the impure quality of the chloroform; it therefore behooves the pharmacist to carefully apply the tests for purity required by the Pharmacopœia to all chloroform sold for this purpose.

Officinal preparations are:

| | | | |
|---|---|---|---|
| Spiritus | chloroformi, | U. S.— | Spirit of Chloroform. |
| Mistura | " | " | Chloroform Mixture. |
| Linimentum | " | " | Chloroform Liniment. |

*Chloral Hydrate*—Chloral U. S.—$C_2HCl_3O, H_2O$—Chloral occurs in colorless, transparent, separate, rhomboidal crystals; caustic taste; neutral reaction. It is produced by treating absolute alcohol to a continuous stream of chlorine gas for six or eight weeks, and treating the solid mass thus obtained with sulphuric acid and purifying by distillation over quick lime.

*Uses*—As a hypnotic, but should be tested for purity when for internal use, and carefully dispensed, as an overdose may produce fatal consequences.

See U. S. P. for tests, etc.

## STARCHES AND SUGARS.

The starches and sugars belong to the carbo-hydrate compounds. Sugars are defined "as organic bodies of

sweet taste, generally of vegetable origin, crystallizable and of a neutral reaction."

Starch is of vegetable origin, and exists in the form of granules, and it is possible to identify the varieties of starch obtained from different plants with the aid of a microscope by the shape and size of the granules.

The starches, sugars, cellulose or cellulin, lignin, and the gums are closely related chemically.

*Amylum* (U. S.)—Starch, $C_6 H_{10} O_5$.—In young plants the starch granule is always spherical, becoming afterward ovoid, lenticular, polyhedral or irregular in shape. Starch is usually obtained from potatoes by separating the cellular substance from the starch. This is done by grating and pressing the soft mass upon a sieve, the starch granules falling through. It is also prepared from wheat or corn by fermentation.

Starch is odorless, tasteless, insoluble in water, alcohol and ether, and gives neither an acid nor an alkaline reaction with test paper. The coloring effect which iodine has upon granulose—staining it a deep violet color—renders it the best reagent for detecting the presence of starch.

Officinal preparations are:

Glyceritum amyli, amylum iodatum.

Among the isomers of starch known, the more important are the *Dextrines—Lichenine*, *Inulin* and *Glycogen.*

The group formed by the starches is called the Amy-

lose group. They may all be converted into the glucoses by the action of acids.

Maltum (U. S.)—*Malt.*

*Preparation.*—Barley is steeped in water until it swells and becomes tender; then the water is drained off, and it is spread (about two feet thick) on a stone floor; it heats spontaneously and germinates. The germination is now partially stopped by making the layer thinner and stirring it up for two days. It is now placed in heaps and allowed to remain for a day, and then dried in a kiln. By the process of germination the starch of the grain is transformed into *maltose*, a peculiar kind of sugar, and dextrin, owing to the presence of *diastase* (a peculiar and powerful ferment) formed during the process. The portion of the starch remaining after this fermentation is still further converted into maltose in the kiln. Diastase is a solid, white, tasteless substance, soluble in water and weak alcohol, and has the extraordinary property, when mixed in one part to two thousand of starch, and suspended in water heated to about 160° F., of converting the starch into dextrin and maltose. This accounts for its use in the form of extracts and foods, etc., as "the quantity of diastase present in good malt has the power of *rendering soluble starchy substances which are taken into the stomach as food.*" It is said that some of the commercial extracts of malt are merely glucose colored with caramel and flavored slightly with the real extract of malt.

Officinal preparation:
Extractum Malti (Extract of Malt).

SUGARS.

As before stated, the compounds of the *sugar group* are closely related to the starches. The sugars, however, are crystalline, sweet or sweetish, and more or less soluble in water. The sugars may be divided into two classes, (1) the fermentable sugars, and (2) non-fermentable. Of these, the fermentable are by far the most important, as they embrace the class which are so largely consumed in food products.

Sugars are also divided into two sub-classes: (1) *Glucoses*, or sugars directly subject to vinous fermentation; and (2) *saccharoses*, or sugars indirectly subject to fermentation.

Prof. Remington classifies them as follows (the saccharoses being fermentable only after being converted into sugar belonging to the class of glucoses):

Glucose (dextro glucose, or dextrose), obtained by treating starch with diluted sulphuric acid, neutralizing the acid with lime, separating the calcium sulphate and evaporating the solution.

Grape sugar (crystallized glucose), obtained by crystallizing the above solution.

Lævulose (lævo glucose), found in the sugar-cane, and may be obtained from molasses.

Maltose, made by the action of diastase on starch.

Dulcitose, obtained by oxidizing dulcit with nitric acid.

Mamitose, found in muscular flesh.

Galactose, made by treating milk sugar with diluted sulphuric acid.

SACCHAROSES, $C_{12}\ H_{22}\ O$.

Cane sugar (saccharose), obtained from sugar-cane, beets, etc.

Parasaccharose, obtained by spontaneous fermentation of sugar-cane.

Milk sugar (lactose, lactin), obtained from milk.

Mycose, obtained from ergot.

Melezitose, obtained from manna.

Melitose, obtained from various species of eucalyptus.

Trehalose, obtained from the cocoons of larinus maculatus.

NON-FERMENTABLE SUGARS.

These are sometimes called saccharoids.

Mannit, obtained from manna and many other plants.

Dulcit, also called Melampyrit, obtained from melampyrit.

Eucalyn, produced in the fermentation of melitose.

Inosit, obtained from muscular flesh.

Quercitose, by decomposing quercitrin with diluted sulphuric acid.

Sorbit, from sorbus aucuparia—mountain ash berries.

Erythromannit, obtained from protococcus vulgaris, also called *phycit*.

Isodulcit, from quercitrin.

Pinit, from pinus lambertiana.

Quercit, obtained from acorns.

Glucose.—It is now obtained by manufacturers on a large scale from starch by the action of dilute sulphuric acid on it. It may also be obtained from candied honey, grapes and other sources. The syrupy product obtained in these processes is termed glucose, while the solid product is called grape sugar. Glucose is not so sweet as cane sugar, nor is it as soluble in water, but it is much more so in alcohol Strong mineral acids act with facility on cane sugar and but sparingly on glucose. Alkalis that form definite compounds with cane sugar readily destroy glucose.

SACCHARUM (U. S.)—*Sugar*, $C_{12}H_{22}O_{11}$.

The refined sugar of *saccharum officinarum.* It is produced on a large scale from sugar-cane, beet root and sorghum. For pharmaceutical uses the granulated sugar is the best, as it does not absorb moisture like loaf sugar, and does not lose weight when kept in dry air.

Saccharum occurs in white, dry, hard, crystalline granules, permanent in the air; odorless; purely sweet taste; neutral reaction. A saturated solution in water at 32° F. contains 65 per cent. of sugar.

Mel (U. S.)—*Honey.* A saccharine secretion deposited in the honeycomb by *apis mellifica.* It has not yet been decided whether honey is secreted by the bee or whether it exists ready formed in plants. The nectaries of flowers contain a sweet substance, which is extracted by the insect. A large amount of honey,

however, is manufactured by flavoring and coloring artificial glucose. The officinal test detects this adulteration through the nitrate of barium test, as artificial glucose, as a general thing, contains some calcium sulphate, which produces a precipitate of barium sulphate.

MANNA (U. S.)—*Manna.* A concrete saccharine exudation of *fraxinus ornus;* of a yellowish white color externally; internally white, porous and crystalline. When pure it is soluble in its own weight of boiling water and in three parts of cold water. It is soluble in alcohol, and when boiled with an alcoholic solution of it it deposits in crystals of a peculiar sweet principle called *mannit*, which occurs in manna and many other plants. Mannit is the principal constituent of manna.

GLYCYRRHIZA (U. S.)—*Licorice Root.* This root contains the sweet principle *glycyrrhizin*, or glycyrrhizic acid. It is used in pharmacy for masking the taste of bitter substances, as quinine, etc.

Officinal preparations:

Extractum glycyrrhizæ; extractum glycyrrhizæ purum; pulvis glycyrrhizæ compositus; extractum glycyrrhizæ fluidum.

GLYCYRRHIZINUM AMMONIATUM (U. S.)—*Ammoniated Glycyrrhizin.* Obtained by percolating licorice root with water and adding sulphuric acid as long as precipitation occurs, and redissolving the precipitate in water, with the aid of water of ammonia, and scaling.

TRITICUM, U. S.—*Triticum* (Couch Grass). The rhizome of *triticum repens*, containing *triticum*, a principle resembling inulin and glucose.

Officinal preparation:

Extractum tritici fluidum (U. S.).

CELLULOSE.

Cellulose or cellulin is the woody fibre of plants forming the skeleton for the vegetable tissues. Its composition is the same as that of starch, and, like it, may be converted into glucose by the action of acids. One of its purest forms is cotton fiber or the hairs taken from the seed of the cotton plant.

GOSSYPIUM (U. S.)—*Purified Cotton.*

*Absorbent cotton.*—Used in the preparation of pyroxylin; also as a dressing for burns, blisters, etc.

Pure cellulin is white, translucent, and unalterable in the air. It is insoluble in water, alcohol or ether.

Among the forms of modified cellulin, the chief are *lignin* and *suberin*. "The substances which are found adhering to the cellulin skeleton of plants and vegetable tissues are called *lignin*. *Suberin* incrusts the walls in the corky layer of the bark. *Pyroxylin* is obtained by treating pure cellulin with a mixture in certain proportions of nitric and sulphuric acid and thoroughly washing and drying the product. An explosive substance also, known as *gun cotton*, is produced.

*Celluloid*, whose uses are so well known, is made from pyroxylin, camphor and coloring matter, which are

heated together and powerfully pressed into the desired shape or mould.

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### Questions on Lecture V.

1. In emplastrum ammoniaei how many parts of diluted aeetie acid?
2. How are the organic aeids built?
3. How is benzoic acid obtained from benzoin?
4. What is tannic aeid ehemically?
5. How is menthyl alcohol obtained?
6. Give the sp. gr. of proof spirit at 60° F.
7. What are the ethers?
8. What is chloroform venale?
9. To what eompounds do the starches and sugars belong?
10. State the common name of Trietieum.

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### Answers to Questions on Lecture IV.

1. By simple solution and straining.
2. Ninety-two parts.
3. By extraetion.
4. The fruit (see table).
5. Upon the amount of the crude drug it represents.
6. Two grains of the drug.
7. Nine.
8. Use only when ingredients possess inherent adhesiveness that it will develop.
9. One grain.
10. Fatty substances.

*Erratum.*—In Lecture IV., page 69, under sub-head "Spirits," second class, the words "solutions of ethereal oils in alcohol," should read, solutions of *volatile* oils in alcohol.

# PHARMACY.

## Lecture VI.

### GUMS.

The gums in their chemical structure are closely related to starch and cellulin. They seldom appear in the animal kingdom, but are of common occurrence in the vegetable kingdom. They are obtained by exudation from many plants on puncturing the bark, and are produced mostly by the transformation of cellulin, or the substance of the cell walls of plants. While some contain an additional molecule of water, the chemical formula of many of them is the same as that of cellulin.

Gum Acacia, U. S. (*Gum Arabic*). Obtained from accacia verek and other species of acacia. It consists mainly of arabic acid, calcium. potassium, arabate, etc., and may be converted into glucose if boiled with dilute sulphuric acid. It is more or less transparent, is hard, brittle and pulverizable, and is bleached by the action of the sun. It has a slightly sweetish taste, and when pure dissolves in the mouth. It is used in pharmacy in the preparation of emulsions, pill masses, syrups, etc.

Officinal preparations: Mucilage accaciæ; syrupus accaciæ.

GUM TRAGACANTH. U. S. (*Tragacantha*). A gummy exudation from the different species of astragalus. It consists of 33 per cent. of bassorin, 53 per cent. of soluble gum (not arabin), 11 per cent. water, and 3 per cent. impurities. It is difficult of pulverization, unless at a freezing temperature, or when thoroughly dried and powdered in a heated mortar.

Officinal preparation: Mucilago tragacanthæ.

A number of drugs in the Materia Medica are indebted for their virtues wholly or in part to mucilages which really belong to one or the other of the above two groups of gum. For instance:

*Ulmus*—(elm)—Inner bark of ulmus fulva.

*Sassafras Medulla*—Pith of sassafras officinalis.

*Cydonium* (quince seed)—Seed of cydonia vulgaris,

*Althæa* (marshmallow)—Root of althæa officinalis.

*Linum*—Seeds of flax, linum usitatissium, etc.

PECTIN.—A principle existing in certain fruits, formed by the action of two other principles—*pectase* and *pectose*—upon each other during the process of ripening. It is the substance in the juices of fruits which causes them to gelatinize. It occurs also in other parts of many plants.

The pectins and pectin acids are closely related to the gums.

*Syrupus Rubi Idæi*—Syrup of raspberry.

## ESSENTIAL OILS.

The essential or volatile oils are widely distributed in the vegetable kingdom; but few, however, appear in the animal structure. They differ from the fixed oils in chemical composition in not leaving a permanent stain on paper; "in being more or less volatile at ordinary temperatures; in the fact that they may be completely volatilized by heat without undergoing chemical change, and in not being saponified by the alkalies." They are soluble in all proportions in alcohol, only slightly so in water, and are inflammable. Nitric acid, if strong, decomposes these oils with great rapidity.

The volatile oils may be divided into four classes: 1. Terpenes, or hydrocarbons, consisting of carbon and hydrogen; nearly all have the formula $C_{10} H_{16}$; type, oil of turpentine. 2. Oxygenated oils or hydrocarbons, containing oxygen; type, oil of cinnamon. 3. Sulphurated oils, containing sulphur; type, essential oil of mustard. 4. Nitrogenated oils, a small class containing hydrocyanic acid; type, oil of bitter almond.

Of the two proximate principles of which volatile oils consist, *stearopten* and *eleopten*, the former congeals at a lower temperature than the latter.

The reaction of iodine with some of these oils occurs with explosive force. Alkalies generally have little effect on them.

These oils are prepared in various ways:

1. By expression—as with oil of orange, and other

cases where the oil is contained in conceptacles in the rind of the fruit.

2. Distillation with water.—This is usually carried on in copper stills, lined with tin, and sufficient water is placed in the still to cover the substance from which it is desired to extract the oil. After distilling, the oil is separated from the water which comes out with it. When the boiling point of the oil is very high common salt is sometimes added to the water to raise it to the boiling point.

3. Distillation *per se*.—Distillation "by itself," as in the case of copaiba, etc.

4. Enfleurage.—Adopted to collect the more volatile essences frequently present in the flowers only in minute proportion; effected by sprinkling the flowers on layers of purified inodorous fat spread on glass. The glasses are fixed in frames resembling window-sashes. The frames are piled in a stack and left to stand for twelve, twenty-four or thirty-six hours. By adding fresh flowers when the material is exhausted, a stronger pomade is obtained, This pomade is treated with alcohol (absolute) to dissolve the essence, and the alcoholic solution obtained is then subjected to a low temperature in order to crystallize and separate what fat remains in it. The product obtained is the "extract" of the perfumers. The volatile oil may be prepared from it by treating it with water when the oil separates out.

5. Maceration.—Effected by allowing the drug containing the desired odor to remain in contact with a

bland, inodorous fixed oil till the odor is absorbed, and after a certain time, straining. Generally used in perfumes.

6. Pneumatic process.—Used with very delicate volatile oils; effected by forcing a current of air into a vessel filled with fresh flowers, and conveying it thence to another vessel containing purified fat; the fat is kept melted, and half immersed circular plates revolve in it, and the coated plates absorb the odor from the air.

7. Percolation.—Effected by percolating the desire flowers with pure carbon disulphide; the latter is distilled and the oils are found in the residue.

By the action of the light and the air on volatile oils the fragrance is destroyed and the oils thicken, resinify, etc. These changes will be greatly retarded if the oils be kept in a dark place in full, tightly-stopped bottles.

Volatile oils, as a general thing, when fresh and pure are colorless; if not they may be deprived of their color by distillation, and when the color has been acquired by standing, rectification will be found to result in a greatly improved product.

*Adulterations.*—The essential or volatile oils are costly enough to cause their adulteration. This is sometimes done by adding a fixed oil to the volatile oil. This may be detected by placing a drop of the suspected oil on a piece of filtering paper or upon clean writing paper. By a slight heat the volatile oil is evap-

orized, and the fixed oil, if present, leaves a permanent stain. Alcohol, if present, may be detected by mixing measured quantities of the oil and water together in a graduated glass tube and observing if contraction occurs; if it should, alcohol is present. Now, volatile oils burn with a yellow, sooty flame, and if the alcohol be present in large quantity it may be detected by burning a small quantity of the suspected oil in a dish in a dark room, when the characteristic blue alcoholic flame will be seen. Aniline red may also be used to detect the presence of alcohol, as it is soluble in it, but not in the volatile oils, so if the suspected oil is colored red on testing, it indicates adulteration. The use of the same oil of an inferior quality, or of a cheaper oil with the same odor, is practiced to a great extent in the adulteration of these oils. The only reliable test in these cases is "the use of the olfactories." Practice will soon render one a sufficiently good judge to detect the adulteration. In testing the essential oils by the sense of smell it is best to rub a drop on the hand, as it will evaporate quicker on the warm hand than from the liquid surface in the bottle.

The class of essential or volatile oils known as the *hydrocarbons* is composed entirely of hydrogen and carbon, nearly all having the formula $C_{10}H_{16}$. They differ from the other groups in having a lower specific gravity, by being transformed into solid resins when treated with nitric acid, and by being less soluble in water.

Those officinal are:

OLEUM CUBABÆ—*Oil of Cubebs.* Distilled from cubebs; is a colorless or pale-greenish or yellowish liquid, with neutral reaction; sp. gr., 0.920. Upon standing it often deposits the crystals of a stearopten.

OLEUM COPAIBA—*Oil of Copaiba* (*Balsam of Copaiba*). The oleoresin of *Copafeira Langsdorffi* and of other species of *Copaifeira;* a more or less viscid liquid, varying in color from pale yellow to brownish yellow; sp. gr., 0.940 to 0.993.

OLEUM JUNIPERI—*Oil of Juniper.* Distilled from juniper. A colorless or faintly greenish-yellow liquid. It fulminates strongly with iodine; sp. gr., about 0.910.

OLEUM SABINÆ—*Oil of Savine.* Distilled from savine. A colorless or yellow liquid; sp. gr., 0.910. It fulminates strongly with iodine.

OLEUM TEREBINTHINÆ—*Oil of Turpentine.* Distilled from turpentine. Formula, $C_{10} H_{16} O_5$; it is the type of the turpenes; colorless; sp. gr., 0.855 to 0.870; of a neutral or faintly acid reaction; fulminates violently with iodine.

THE OXYGENATED OILS are hydrocarbons containing oxygen; they are more soluble in water, however, than the hydrocarbons.

The following are officinal (Hallberg):

| | Part of Plant. | Plant. |
|---|---|---|
| Oil of Anise | fruit | Pimpinella anisum. |
| " Star anise | seed | Illicium anisatum. |
| " Neroli | flowers | Citrus vulgaris. |

| | | Part of Plant. | Plant. |
|---|---|---|---|
| Oil of | Bergamot | fruit | " limetta[1]. |
| " | Orange | fruit | " vulgaris[1]. |
| " | Lemon | fruit | " limonum[1]. |
| " | Cajeput | leaves | Melaleuca cajeputi. |
| " | Caraway | fruit | Carum carui. |
| " | Cloves | flower buds | Caryophyllus aromaticus |
| " | Wormseed | seed | Chenopodium anthelminticum. |
| " | Cinnamon | bark | Cinnamom aromaticum " Zeylanicum. |
| " | Coriander | fruit | Coriandrum satium. |
| " | Erigeron | herb | Erigeron Canadense and " Philadelphicum |
| " | Eucalyptus | leaves | Various species of eucalyptus. |
| " | Fennel | fruit | Fœniculum vulgare. |
| " | Wintergreen | herb | Gaultheria procumbens. |
| " | Pennyroyal | herb | Hedeoma pulegioides. |
| " | Lavender | herb and flowers | Lavandula vera. |
| " | Peppermint | herb | Mentha piperita. |
| " | Spearmint | herb | " viridis. |
| " | Bay | leaves | Myrcia acris. |
| " | Nutmeg | kernel and aril | Myristica moschata. |
| " | Allspice | fruit | Eugenia Pimenta. |
| " | Rose | petals | Rosa Damascena. |
| " | Sandalwood | from wood | Santalum myrtifolium. |
| " | Sassafras | bark | Laurus sassafras. |
| " | Thyme | herb | Thymus vulgaris. |
| " | Rosemary | herb | Rosmarinus officinalis. |
| " | Rue | herb | Ruta graveolens. |
| " | Valerian | root | Valeriana officinalis. |

[1] These three are mixtures of hydrocarbons with oxygenated oils.

The Nitrogenated Oils are a small class containing hydrocyanic acid. The most important are oil of cherry seeds, oil of cherry, laurel leaves, and

Oleum Amygdalæ Amaræ, U. S.—*Oil of Bitter Almonds.* A colorless thin or yellowish thin oil ; aromatic odor ; neutral reaction. Obtained by macerating bitter almonds with water and subsequent distillation.

The Sulphurated Oils all contain sulphur. The only one officinal is

Oleum Sinapis Volatile—*Volatile Oil of Mustard.* Obtained from black mustard by maceration with water and subsequent distillation ; a colorless or pale yellow liquid, and neutral reaction ; sp. gr., 1.017 to 1.021.

The Empreumatic Volatile Oils are obtained from organic substances by dry distillation or by the slow decay of organic substances. The petroleums, for instance, are examples of oils produced by the gradual decay of organic substances under certain conditions.

Oleum Succini, U. S.—*Oil of Amber.* "Obtained by the destructive distillation of amber and purified by subsequent rectification" (Remington) ; a pale yellow liquid ; sp. gr., 0.920.

To this class belong kerosene, paraffin, pyrene and napthalin, and many other substances. They differ much from each other chemically as well as physically. "They agree in being but little affected by cold nitric acid and in not fulminating with iodine" (Hallberg).

STEAROPTENS FROM VOLATILE OILS.

Camphora, U. S.—*Camphor.* Obtained by distilling chips of the wood, branches and the roots of cam-

phora officinarum with water, and purified by subsequent sublimation; a white, translucent, solid substance of crystalline structure, penetrating odor and taste, and luminous, smoky flame; sparingly soluble in water, readily so in alcohol, ether, etc. So tough are its crystals that it cannot be pulverized unless first dampened with a little alcohol, ether or chloroform.

Officinal preparations:

Aqua camphoræ; ceratum camphoræ; linamentum camphoræ; spiritus camphoræ.

CAMPHORA MONOBROMATA. Occurs in colorless prismatic needles or scales, unaffected by light and air; camphoraceous (mild) odor and taste; neutral reaction; obtained by heating camphor and bromine together and recrystallizing in petroleum benzine.

### THYMOL.

Obtained from the volatile oil of several plants by fractional distillation, etc.; occurs as a solid, in nearly or quite colorless crystals; slightly soluble in water, but freely so in alcohol, ether, etc.

### RESINS.

Resins are amorphous exudations from plants. They are generally the oxidized terpenes of plants. They are insoluble in water, but soluble in alcohol; derived pure, they are generally transparent, brittle and hard. When water is present they are opaque and soft. They are inflammable, burning with a sooty flame. They occur numerously throughout the vegetable kingdom, as

there are but few plants destitnte of them. Their formation is probably due to the decay or deterioration of the plant. In the following we give the most important natural resins:

GUAIAC—*Guaici Resina*, U. S. Obtained from guaiacum officinale; prepared by boiling guaiac chips in salt water, collecting resinous scum, melting and straining.

*Composition.*—Guaiacic acid, guaiaconic acid, guaiaretic acid, beta resin, gum, etc.

Officinal preparations:

Tinctura guaiaci; tinctura gnaiace; ammoniata.

MASTICHE, U. S.—*Mastic.*—A concrete resinous substance obtained from pistacia lentiscus. It is partly soluble in alcohol and fully so in ether and the volatile oils. Sandarac resembles mastiche, and is sometimes used to adulterate it. It occurs, however, in more elongated tears, and becomes powdery when masticated, and is almost completely soluble in alcohol. Consists of mastiche acid, masticin and trace of volatile oil.

Officinal preparation: Pilulæ aloes et mastiches.

COPAIBÆ, U. S. The product remaining when copaiba is deprived of its volatile oil by distillation.

*Description.*—Yellowish or brownish yellow brittle masses; soluble in alcohol, benzol, etc.; alcoholic solution acid in its reaction.

*Composition.*—Copaivic and meta-copaivic acids with neutral resin.

ELETERIUM.—A substance obtained from the squirt-

ing cucumber, Ecballium elaterium. The juice of the cucumber is allowed to stand until it deposits a sediment. This, carefully collected and dried, is elaterium.

*Description.*—Of a yellowish white color slightly tinged with green; very light; odor faint; taste acrid, bitter. A mild astringent.

*Constituents.*—Elaterin, ecballin, hydro-elaterin and elateride.

*Uses.*—An active hydragogue cathartic.

Resina, U. S.—*Resin Colophony.* Obtained from the pinus Australis and other species of the same genus. Consists of abietic anhydride; obtained for commercial purposes by distilling off the volatile oil from the crude turpentine or oleoresin and subsequent colation of the product while hot. It passes into abietic acid if subjected to the action of diluted alcohol.

*Description.*—Transparent, amber colored, and hard and brittle; faintly terbinthinate odor and taste; sp. gr., 1.070; soluble in alcohol, ether, etc.

*Uses.*—For adhesiveness in plasters and in ointments and cerates.

Officinal preparations: Ceratum resinæ; emplastrum resinæ.

Succinum—*Amber.* A fossil resin of an extinct coniferous weed, and obtained principally on the shores of the Baltic, as it is cast up by the waves, or dug out of beds.

*Description.*—Hard, brittle, whitish-yellow or red-brown, transparent, translucent or opaque; masses irregular in form, and frequently contains vegetable frag-

ments and insects. When heated it gives off a fragrant odor. Sp. gr., 1.09. It dissolves in chloroform, but is scarcely soluble at all in alcohol, ether, etc.

*Constituents.*—Succinic acid, together with various resins.

*Uses.*—The source from which succinic acid and oil of amber are derived.

Officinal preparation: Oleum succini.

Among the resins handled by druggists, but not of pharmaceutical use, are:

*Copal Resin*—Found fossil in Africa, and also obtained from various leguminous trees of the tropics; used chiefly for varnish.

*Dammara*, or *Dammar Resin.*—Occurs in the coniferous trees, Dammara Orientalis of the East Indies and Demmara Australis of New Zealand, where it is also sometimes found fossil. This resin is sometimes used in the preparation of plasters on a large scale, but its chief use is for varnishes.

*Sandarac*, or *Tandarac Resin.*—The spontaneous exudation of an African tree of the natural order of coniferæ: used chiefly for varnishes.

*Shellac*, or *Lacca.*—An exudation caused by the puncture of the female insect of coccus lacca, and occurring in East Indian and Mexican plants. Obtained chiefly from the East Indies. About the most important trees which produce it appear to be the aleuritis laciffera and ficus Indica, a fig tree.

*Asphaltum*—One of the series of petroleum products.

Occurs in extensive deposits in the Isle of Trinidad and in other countries. Used in making varnishes and for various other purposes.

### OLEORESINS.

The oleoresins are of vegetable origin, and consist of resins with volatile oils in various proportions.

Copaiba, U. S. (" *Balsam of Copaiba*"). Obtained from different species of copaifera—notably copaifera Langsdorffii—natural order leguminosæ. It contains copaivic acid, volatile oil and a bitter principle soluble in water. It is obtained from Para in Brazil, and Maracaibo, Venezuela, and other parts of South America, the Maracaibo copaiba being denser and deeper colored than others.

*Description.*—A transparent or translucent viscid liquid; color ranging from light yellow to brownish yellow; sp. gr., 0.993; acrid and nauseous taste with peculiar aromatic odor.

Copaiba is often adulterated, Gurjun balsam and fixed and volatile oils being used for this purpose. (See U. S. Dispensatory for tests.) It is insoluble in water, but is readily soluble in absolute alcohol, ether, benzole, etc.

*Uses.*—Expectorant, diuretic and stimulant, having a special irritant action on the mucous membranes of the urinary passages; also applied externally.

Officinal preparations: Massa copaibæ and resina copaibæ.

GURJUN OLEORESIN ("*Gurjun Balsam*") From dipterocarpus turbinatus; natural order, dipterocarpaceæ; habitat India and the Malay Archipelago. It consists of gurjunic acid, resins and volatile oil. It is only partially soluble in alcohol and ether, but is entirely so in the volatile oils, etc.; sp. gr., 95 to 96.

*Uses.*—Similar to those of copaiba.

### THE TURPENTINES.

The turpentines are the product of trees belonging to the natural order coniferæ, with one exception—cyprus turpentine—which is an exudation from pistacia terebinthus. Tar is obtained by the destructive distillation of wood. It is said that thin volatile oils are "identical in chemical structure, though differing somewhat in odor." Their chemical formula, if the oils be pure, is $C_{10}H_{16}$.

TEREBINTHINA, U. S. — *Turpentine.* Exudation from pinus Australis and other species of pinus. A semi-fluid oleoresin, which contains abietic anhydride, a bitter principle and a volatile oil.

*Uses.*—Diuretic, astringent and stimulant; also used in ointments and plasters.

TEREBINTHINA CANADENSIS, U. S.—*Canada Turpentine* (*Balsam of Fir*). A liquid or semi-liquid oleoresin; product of the abies balsamea—balsam fir.

*Description.*—Yellowish or slightly greenish, transparent, and with age acquiring a yellow color and hardening. It contains a volatile oil and two resins, and is

used principally in mounting microscopic objects. It is a stimulant, diuretic and diaphoretic.

TEREBINTHINA VENETA, or *Laricina.* From the European larch, larix Europæa; natural order, coniferæ. Imported from Tyrol and Switzerland. It is a dense, nearly transparent, or slightly opaque, fluorescent liquid, with terebinthinate odor, and a yellowish or greenish yellow color; freely soluble in alcohol, acetone and glacial acetic acid.

*Uses.*—Same as Canada turpentine.

TEREBINTHINA ARGENTORATENSIS—*Strasburg Turpentine.* From abies pectinata; natural order, coniferæ. It is found in the Vosges, and resembles Canada balsam in its composition, properties and uses. Odor somewhat resembling that of lemon.

PIX BURGUNDICA, U. S.—*Burgundy Pitch.* The prepared resinous exudation from abies excelsa, or Norway spruce fir; natural order, coniferæ; habitat, northern and central Europe and northern Asia.

*Description.*—Hard and brittle, but yielding to slow pressure without fracture; semi-transparent or opaque; yellowish or generally of a dull reddish brown color; odor and taste aromatic.

*Constituents.*—Volatile oil, which it is suggested is isomeric with oil of turpentine, and a resin.

*Adulterations.*—It is said that "the substance commonly sold in England is made by melting together colophony with palm oil or some other fat, water being stirred in to render the mixture opaque. Hanbury de-

scribes artificial Burgundy pitch as forming a turbid mixture with glacial acetic acid which separates into two layers—a thick, oily liquid above and a bright solution below. Pure Burgundy pitch is almost entirely soluble in glacial acetic acid." Used as a basis for plasters.

Officinal preparations: Emplastrum picis Burgundicæ; emplastrum picis cantharide.

Pix Canadensis, U. S.—*Canada Pitch* (Hemlock Pitch). A prepared resinous exudation obtained from abies Canadensis (common hemlock); natural order, coniferæ. It contains resins; a terpene, $C_{10}H_{16}$, and water; occurs in opaque reddish brown masses; brittle at ordinary temperatures, and usually assuming the form of the container, and being nearly identical with Burgundy pitch as to its action, properties and uses.

Officinal preparation: Emplastrum picis Canadensis.

Terebinthina Chia—*Cyprian* or *Chian Turpentine.* Obtained by making incisions in the bark of pistacia terebinthus; natural order, anacardiaceæ, a small tree indigenous in the Mediterranean basin and eastward Asia.

*Description.*—Transparent, semi-fluid or hardened; color, greenish yellow or brownish; order, terebinthinate and somewhat fennel-like, with mildly bitter taste. It is used like the other turpentines.

Elemi—*Elemi.* The botanical source of this concrete resinous exudation is undetermined, but is supposed to be derived from trees of the natural order

burseraceæ. That obtained from Manila is probably from Canarium commune, and that from Brazil from Icica Icicariba, etc. It contains volatile oil, crystalline and amorphous resins and elemic acid.

*Description.*—Manila elemi occurs in soft, granular, transparent masses when freshly obtained, but when old it is found in the shops in solid pieces, and is externally of a pale lemon-yellow color; taste disagreeable and bitter; odor, aromatic.

*Uses.*—Stimulant and irritant; also used in ointment and plasters.

PIX LIQUIDA, U. S.—*Tar.* Product of various species of pines, and obtained as a by-product in the destructive distillation of the wood. It is manufactured mostly in North Carolina; natural order, coniferæ.

*Description.*—A thick, viscid, semi-fluid mass, with blackish-brown color, and becoming thicker with age, with acid reaction; soluble in water sparingly, freely so in alcohol, volatile oils, ether, etc. It is of a composition, varying with the wood. The lighter products are acetic acid, acetone, methyl alcohol, toluol, xylol, cumol and menthol; the heavier are pyrene, chrysene, napthalin, paraffin, phenol, creosote, resin, etc.

*Uses.*—Stimulant, irritant and expectorant; used externally in skin diseases and for fumigation.

Officinal preparations: Syrupus picis liquidæ; unguentum picis liquidæ.

BALSAMS.

The term balsams is often loosely used in reference

to certain resins, oleoresins and various mixtures. In accordance with the plan which we propose to follow we shall here restrict the term to liquid, semi-liquid and solid vegetable products which contain an oleoresin, or resin with benzoic or cinnamic acids, or both. The same classification is adopted by Prof. Remington and others.

BALSAMUM TOLUTANUM, U. S.—*Balsam of Tolu.* Obtained from the leguminous tree, myroxylon toluifera; natural order, leguminosæ papilionaceæ.

*Description.*—Liquid or semi-liquid when first obtained, but hardening as kept; color, yellowish or reddish brown; odor and taste, aromatic; soluble in alcohol and ether. It contains cinnamic and benzoic acids, resins, benzyl benzoate, benzyl cinnamate and tolene. Sulphuric acid is used as a test to discover adulterations, as it turns pure balsam of tolu to a cherry red and bleaches it if it contains turpentine.

*Uses.*—Stimulant and expectorant.

Officinal preparations: Tinctura tolutana; syrupus tolutana.

BALSAMUM PERUVIANUM, U. S.—*Balsam of Peru.* Derived from myropylon pereiræ; natural order, leguminosæ papilionaceæ. It contains both cinnamic and benzoic acids, benzyl cinnamate, benzyl benzoate, resin, etc.; a thick molasses-colored liquid, having a syrupy consistence, but transparent and of reddish brown color in thin layers; odor somewhat smoky, but agreeable and aromatic; taste warm and bitter, after-

wards acrid; soluble in five parts of alcohol; miscible with chloroform and glacial acetic acid (see U. S. P. for tests). Internally it is a stimulant and aromatic; externally used in ointments, etc.

BENZOINUM, U. S.—*Benzoin.* Derived from styrax benzoin; natural order, styraciæ.

*Composition.*—Benzoic and cinnamic acids, resins, a volatile oil, and in some kinds, vanillin. Alcohol is said to be the best solvent for its active principles. Used as a stimulant and expectorant.

Officinal preparations: Adepes benzoinatus; tinctura benzoini; tinctura benzoini composita.

STYRAX, U. S.—*Storax.* Obtained from the inner bark of liquidamber orientalis; natural order, hamamelaceæ balsamifluæ. It consists of cinnamic acid, benzoic acid, styracin, storesin, styrol, resin, etc.

*Description.*—Liquid (consistency of thick honey), but hardening when kept standing; odor strong, agreeable, resembling somewhat that of vanilla; soluble in alcohol, ether and carbon disulphide. The tree from which it is obtained closely resembles the sweet-gum tree of North America. It grows in forests in Asia Minor.

*Uses.*—Stimulant and expectorant, and used in the compound tincture of benzoin.

### GUM-RESINS.

The gum-resins are defined as "natural mixtures of gum and resin—usually exudations from plants."

MYRRHA, U. S.—*Myrrh.* Exudation from balsamodendron myrrha; natural order, burseraceæ.

*Composition.*—3 per cent. volatile oil, about 30 per cent. gum, 60 per cent of resin, a bitter principle, and ash.

*Uses.*—Stimulant, tonic and vulnerary. Also used in compound myrrh mixture, pills, etc.

Officinal preparation: Tinctura myrrhæ.

GALBANUM, U. S.—*Galbanum.* Exudation from ferula galbaniflua; natural order, umbelliferræ orthospermæ. It consists of about 7 per cent. of volatile oil, 20 per cent. of gum, and about 65 per cent. of resin. There are two kinds—tears and lump galbanum. The lump is probably obtained from a different species of plant, as when treated with alcohol and then with chlohydric acid it does not change color, while the former kind turns purplish when so treated.

*Uses.*—In pills and plasters; antispasmodic, expectorant and stimulant.

Officinal preparations: Pilulæ galbani compositæ; emplastrum galbani.

ASAFŒTIDA, U. S.—*Asafœtida.* An exudation obtained by making incisions in the root of ferula narthex and root of ferula scorodosma; natural order, umbelliferæ orthospermæ.

If good, asafœtida should contain 60 per cent. of matter soluble in alcohol. When it is treated with alcohol and then with chlohydric acid a greenish color is produced. It forms an emulsion with water. It con-

sists of gum, 20 per cent.; resin, 50 to 70 per cent., and ferulyl sulphide, a sulphurated volatile oil, and some impurities.

*Uses.*—Antispasmodic and laxative.

Officinal preparations: Mistura asafœtidæ; tinctura asafœtidæ; emplastrum asafœtidæ; pilulæ asafœtidæ.

Ammoniacum, U. S.—*Ammoniac.* A spontaneous exudation from dorema ammoniacum; natural order, umbilliferæ, orthospermæ. Occurring in separate or agglutinated tears; that which is found in cakes of tears, etc., agglutinated in a brown mass, is not considered pure enough for medicinal use. It is of a light yellowish-brown color externally, and does not change its color when treated with alcohol and then with chlohydric acid. It consists of about 3 per cent. of volatile oil, about 23 per cent. of gum, and about 70 per cent. of resin.

Officinal preparations: Mistura ammoniaci; emplastrum ammoniaci; emplastrum ammoniaci cum hydrargaro.

Cambogia, U. S.—*Gamboge.* Product of garcinia hanburii; natural order, guttiferiæ. It consists of about 72 per cent of resin, known as gambogic acid, 16 to 20 per cent. of gum, with water, etc. It forms an emulsion with water, which, if it be first-class, should be of a bright yellow color.

*Uses.*—A strong hydragogue cathartic, and generally used in combination with other medicines.

Scammonium, U. S.—*Scammony.* Obtained from

the root of convolvulus scammonia; natural order, convolvulaceæ. It consists of 80 to 90 per cent. of resin, known as *scammonin*, which possesses cathartic properties, 5 to 25 per cent. of gum, etc. It forms a dark greenish emulsion with water.

*Uses.*—As hydrogogue cathartic.

Officinal preparation: Resina scammonii.

EUPHORBIUM—*Euphorbium.* Obtained from euphorbium resinifera. It consists of 18 per cent. of gum and 38 per cent. of resin, etc.

*Uses.*—Externally, rubefacient, vesicant and suppurant; internally, a violent, dangerous purgative and emetic.

OLIBANUM—*Frankincense.* Obtained from different species of boswellia. It consists of 6 per cent. of volatile oil, 56 per cent. of resin, about 30 per cent. of gum, etc.; natural order, burseraceæ.

Used chiefly for plasters and fumigations; internally, as tonic and stimulant.

## THE FATTY OILS.

The fats are obtained from both the vegetable and the animal kingdoms, and are *greasy to the touch and leave a permanent greasy stain on paper.* They are insoluble in water, and only slightly so in alcohol, usually, but are soluble in ether, chloroform, carbon disulphide, benzol, benzoin, turpentine and volatile oils, generally mixing without separating from one another. The fixed oils are all combustible, burning

with a sooty flame and giving off much heat. Some on standing become rancid and some change into flexible solids and are known as the *drying oils.* Considered from a chemical standpoint, the fluid oils are mixtures and are ethers of the higher members of the fatty acids, the alcohol being glycerin and the radical glyceryl. They usually consist of two or three proximate principles known as olein, palmitin or stearin, in combination with glyceryl, hence they are sometimes known as glycerides of oleic, palmitic and stearic acid.

As quite a number of these oils, if left exposed to the light and air, even when pure, undergo gradual change, they should be kept in closed vessels and in a cool place. Where they have become rancid they may often be obtained pure again by shaking them thoroughly with hot water and afterwards with a cold solution of sodium carbonate and finally washing them in cold water.

*Olein* is defined as being "the oleate of the triad radical glyceryl, obtained by treating oils or fats with boiling alcohol, cooling, to deposite the concrete principles, the olein remaining in solution, which is obtained by evaporating off the alcohol or by compressing one of the solid fats, or a liquid fat concreted by cold, between folds of bibulous paper, which absorbs the olein and gives it up afterward by compressing under water." It is an oily liquid, congealing at 212° F., is colorless and insoluble in water, but is soluble in boiling alcohol and ether.

*Palmitin* is the glyceride of palmitic acid, or tripalmitate glyceryl.

*Stearin* is a glyceride of stearic acid. It is made on a large scale to use in candles by cooling lard and tallow and afterwards separating the olein out by hydraulic pressure. When crystallized from ether it is obtained as a white opaque mass of a pearly appearance, and fuses at 152° F. It is insoluble in water and nearly insoluble in alcohol and ether when cold, but soluble in both when boiling.

*Stearic acid* is a firm solid, similar to wax, white in color, and fusing at 157° F. It is insoluble in water, but is soluble in both alcohol and ether. In the impure state it is substituted for wax in making wax candles.

*Palmitic acid* exists in a white, scaly mass, and fuses at 143.6° F.

*Oleic acid* is an oily liquid, crystallizing in needles at a little below 32° F. It is insoluble in water and soluble in alcohol and ether.

The fixed oils have been classified as follows by Hallberg:

I. Those which contain glycerin—

1. Liquid fats:

| | |
|---|---|
| a. Drying oils................ <br> b. Non-drying oils......... | Vegetable. <br> Animal. |
| c. Oils partaking partly of the character of both........................ | Fish oils. <br> Cotton-seed oil group. <br> Castor oil group. |

2. Solid fats:
   a. Those containing volatile oil (odorous).
   b. Those not containing volatile oil (non-odorous).

II. Those which contain no glycerin, including the waxes.

THE DRYING OILS.

The most important members of this group are:

Oleum Lini, U. S.—*Flaxseed Oil.* Obtained from flaxseed, without the aid of heat, by expression. Heat is used in making the oils on a large scale for use in the arts, etc., and is rejected by the officinal description. It consists mainly of linolein, which by expressure becomes linoxyn. Color, yellowish or yellow, or if made by hot pressure, darker; has a slight odor, bland taste and neutral reaction; soluble in five parts of absolute alcohol and in 1.5 parts of ether.

*Uses.*—Laxative and demulcent externally as protective.

Oleum Papaveris.—*Poppy-seed Oil.* Obtained from the seeds of papaver somniferum; natural order, papaveraceæ; color, yellow; odor, slight, with bland taste.

*Uses.*—Demulcent, externally, protective.

*Oil of Hemp-seed.* Of a greenish or brownish yellow color, peculiar odor and mild taste, and readily soluble in boiling alcohol. A demulcent and protective.

*Nut Oil.* Obtained from the kernels of the juglans regia (English walnut). Of a greenish or a pale yellow color, and congeals at about 0° F.

*Uses.*—Demulcent and protective.

NON-DRYING OILS.

These oils have been divided into two kinds, those derived from the vegetable kingdom and those derived from the animal kingdom.

Those of vegetable origin are: Olive, almond, colza, benne, mustard,, rape, earth-nut.

Those of animal origin are: Neatsfoot, lard, tallow and bone oil.

Of the first class the more important are:

OLEUM OLIVÆ, U. S.—*Olive Oil, Sweet Oil.* Obtained from the fruit of olea Europæa, and is largely adulterated with cotton-seed oil. Color, pale yellow, or greenish yellow; neutral reaction, slight but agreeable odor and bland taste, congealing completely at or below the freezing point of water.

OLEUM AMYGDALÆ—*Oil of Almond.* Obtained by pressure from bitter or sweet almond. Color, clear, colorless, or slightly tinged a greenish yellow; odor, faint, nutty; taste, bland, sweetish; congeals at about 4° F.

*Uses.*—Lenitive and demulcent.

Officinal preparation: Unguentum aquæ rosæ.

Of the animal non-drying class the most important are:

OLEUM BUBULUM—*Neatsfoot Oil.* Made by boiling the fatty tissue of neatsfeet with water. Slight odor and taste; sp. gr., .915. Used externally and for softening leather.

OLEUM ADIPIS, U. S.—*Lard Oil.* Obtained from

lard by exposing it to a low temperature and heavy pressure in a hydraulic press. It consists principally of olein, and is of a clear or pale yellowish color; faint fatty odor and bland taste. It is generally adulterated with paraffin oil. It is used in pharmacy principally as the base of citrine ointment, and paraffin oil when present prevents solidification.

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## Questions on Lecture VI.

1. What are gums related to in their chemical structure?
2. From whence are the essential or volatile oils mostly obtained?
3. How may volatile oils be deprived of their color?
4. What effect does iodine have on oil of turpentine?
5. Give the botanical name of "squirting cucumber."
6. What are gum resins?
7. How much matter soluble in alcohol should good asafœtida contain?
8. Of what does scammonium consist?
9. What are fixed oils from a chemical standpoint?
10. How is oleum adipis obtained?

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## Answers to Questions on Lecture V.

1. 140 parts.
2. On the type of the water molecule.

3. By sublimation.
4. An anhydride of gallic acid.
5. By the dry distillation of wood.
6. .836.
7. The product of the action of the acids on alcohol.
8. Commercial chloroform.
9. To the carbo-hydrate compounds.
10. Couch grass.

# PHARMACY.

## Lecture VII.

### OILS POSSESSING CHARACTERISTICS SIMILAR TO DRYING AND NON-DRYING OILS.

These have been classed as follows:

1. The Fish Oils. 2. The Cotton-seed Oil Group. 3. The Castor Oil Group.

The Fish Oils are: Cod oil, Sperm oil, Cod-liver oil, Porpoise oil, Hake oil, Shark oil, and some others.

The Cotton-seed oil group is: Cotton-seed oil, Beechnut oil, Sessami oil, Sunflower oil, and others important to pharmacy. On standing exposed to the air they become more viscid, and are all bland to the taste and nearly odorless.

### THE CASTOR OIL GROUP.

This group includes the *Croton oils* also. These oils differ from the others in being freely soluble in alcohol and in the fact that they act as strong purgatives.

Below we give the most important:

OLEUM MORRHUÆ, U. S.—*Cod-liver Oil.* Obtained from the fresh livers of gadus morrhuæ and other species of gadus, by heating by low pressure steam, or slowly heating in the presence of water. It consists principally of olein; palmitin and stearin are also present in small quantities, with traces of other substances. It is a thin oily liquid, colorless or pale yellow; odor, fishy; taste, fishy and disagreeable. It is scarcely soluble in alcohol, but is readily soluble in ether. (See Dispensatory for tests.)

OLEUM GOSSYPII SEMINIS, U. S.—*Cotton-seed Oil.* Obtained by hydraulic pressure from the kernels of the seed of gossypium herbaceum. These contain 15 per cent. of oil. It is a bright, pale yellow, oily liquid, with slight odor; taste, bland and nutty; readily soluble in ether, but only slightly so in alcohol; neutral reaction; begins to congeal at 36°.6 F.; contains olein, palmitin and yellow coloring matter. Officinally it forms the oily basis for the liniments of ammonia, lime, camphor and subacetate of lead.

OLEUM SESAMI, U. S.—*Benne Oil.* Obtained by pressure from the seeds of sesamum indicum; contains 70 per cent. of olein, with palmitin, stearin and myristicin. It is not a drying oil. Color, transparent yellow; odor, slight, or none; congeals at about 23° F. It resembles olive oil in its properties and may be used for similar purposes.

OLEUM RICINI, U. S.—*Castor Oil.* Obtained from the seeds of ricinus communis; the best is made by

cold pressure. It is transparent and almost colorless: odor, faint; taste, nauseous. It solidifies into a yellowsh mass at about 0° F. It is soluble in all proportions in absolute alcohol or in glacial acetic acid, and is soluble in an equal weight of alcohol. Used as a purgative.

OLEUM TIGLII, U. S.—*Croton Oil.* Obtained by pressure from the seed of croton tiglium; color, yellowish or brownish; odor, slight and fatty; taste, acrid burning at first, mild and oily. When fresh, soluble in about 60 parts of alcohol, its solubility increasing with age; freely soluble in ether, chloroform or disulphide of carbon. Contains palmitin, stearin, laurin, myristin, with tiglinic, valerianic and other acids. A dose of one minim is a powerful purgative. It is rubefacient and vesicant.

## SOAPS.

If fats or oils be mixed with salafiable bases the olein, palmitin and stearin become changed into their respective acids, as oleic, palmitic and stearic acids, and these unite with the base and form soap. Soaps consist of oleates, palmitates and stearates, according to the proportion of these in the fats. Soaps are divided into two classes—the soluble and the insoluble. They are made hard by using a fat rich in stearin, as tallow for instance, and soda for an alkali, and are soft when made with fats containing a large proportion of olein, with potassa for the alkali. The soluble soaps

are combinations of the fatty acids with soda, potassa or ammonia. Some of the insoluble soaps are employed in pharmacy, as, for instance, the soap of lead monoxide (litharge), or lead plaster, and the soap of lime, or lime liniment. The insoluble soaps are combinations of the fatty acids with earths or metallic oxides, as alumina or lead. Soluble soaps consist of those made with soda and potassa, and are called hard soap and soft soap.

### SOLUBLE SOAPS.

SAPO, U. S.—*Soap.* It is known as castile soap, and is made with olive oil. It is a laxative and an antacid. It is used in pill masses, liniments, plasters, cerates, etc.

Officinal preparations: Emplastrum saponis, linimentum saponis.

SAPO VIRIDIS—*Green Soap.* This is a soft soap prepared from fixed oils and potassa. It is used in skin diseases, chiefly eczema; also in ointments. When dried to a constant weight it should not lose more than 40 per cent. in weight.

Officinal preparation: Tinctura saponis viridis.

### INSOLUBLE SOAPS.

These are usually made by a double decomposition between a soluble soap and a solution of the salt of the metal in boiling water. They are also called oleates.

Their preparation may be illustrated by the following process:

| | Parts. | | Parts. |
|---|---|---|---|
| Zinc sulphate... ........ | 1 | Soap (white)............ | 2 |
| Water dist................ | 10 | Water........................ | 10 |

Dissolve the zinc sulphate in the water and filter the liquid. The soap is sliced and dissolved in the water upon a water-bath and then strained. The zinc solution is added very slowly to the solution of soap while boiling under constant stirring until it ceases to produce a precipitate. Upon cooling, the insoluble soap will form a crust on the surface of the clear liquid which contains sodium sulphate in solution. The soap is broken up, dried and powdered.

Insoluble soaps are made in a similar manner from the various salts, as, for instance, lead oleate from lead acetate, by the foregoing process.

### THE SOLID FATS.

These include all the compounds of glycerin which are solid at ordinary temperatures; some of them are of vegetable and some of animal origin.

Oleum Myristicæ Expressum.—*Expressed Oil of Nutmeg, or Oil of Mace.* Obtained by expressing nutmegs between heated plates or macerating them in carbon disulphide and distilling the macerate. It melts at about 113° F.; odor, aromatic; taste, spicy; soluble in four times its weight of strong alcohol.

*Uses.*—Stimulant and carminative.

Oleum Lauri.—*Laurel Oil.* A pale yellow oxygenated oil, obtained from the leaves and fruit of L. Nobilis. It consists of volatile and fixed oils, also resin, etc., and melts at about 105° F.

*Uses.*—Stimulant, nervine; externally in ointments, etc.

The solid fats belonging to the second group contain no volatile oil but an odorous principle. Some belong to the animal kingdom and some to the vegetable. The most important of these are:

OLEUM PALMÆ.—*Palm Oil.* Obtained from the fruit of elais guinensis; natural order, palmæ; melts at about 80°.6 F.

Used sometimes as a demulcent, but mainly in soap. It contains olein, palmitin and a coloring principle.

OLEUM THEOBROMÆ, U. S.—*Oil of Theobroma.* Obtained from the seed of theobroma cacao; natural order, sterculiaceæ. It is also called butter of cacao. A yellowish-white solid; odor, faint, agreeable; taste, bland, chocolate-like; neutral reaction; melting between 86° to 95° F. Chemically it is considered as a mixture of stearin, palmitin, olein, arachin and laurin. It is used in making suppositories and ointments.

OLEUM COCOIS.—*Cocoanut Oil.* Obtained from the seeds of cocos mucifera; natural order, palmæ. Consistence of butter; color, white; taste, bland; odor, peculiar. It rapidly becomes rancid and of a disagreeable odor and taste. Melts at about 80° F.

BUTYRUM.—*Butter.* Obtained from the milk of the cow—bos taurus. It is a soft, yellow, neutral substance; odor, pleasant; taste agreeable; melts at about 80° F. Consists of olein, palmitin, stearin and small quantities of glycerides of butyric and other acids.

*Uses.*—Demulcent; also in ointments.

### THE NON-ODOROUS SOLID FATS.

Of these the principal are:

ADEPS, U. S. Obtained from the fatty tissues of *sus scrofa;* odor, faint, if not rancid; taste, bland; reaction neutral; melts at about 95° F.

Used in ointments and cerates.

SEVUM, U. S.—*Suet.* Obtained from the internal fat of the abdomen of ovis aries. Should be kept in well-closed vessels and not used after rancid. It is firmer than lard, as it contains more stearin; color, white; taste, bland; reaction, neutral; melts at about 115° F.

Used in making cerates and ointments.

### THE WAXES AND PETROLATUM.

These belong to the second of the two principal divisions of the fixed oils and comprise those which, instead of glycerin, contain a complex monatomic alcohol. They include beeswax, Chinese wax, Brazil wax, myrtle wax, spermaceti wax, palm wax, with others.

The most important pharmaceutically are:

CERA FLAVA.—*Beeswax.* Obtained from the honeycomb of the bee; melts at 145° F. A concrete aromatic substance, nearly tasteless, with honey-like odor.

CERA ALBA, U. S.—*White Wax.* Obtained from the yellow by exposing it in thin layers to the action of light and moisture till bleached. A yellowish-white substance, generally in the form of circular cakes; odor, slightly rancid; taste, insipid; melts at 149° F.

Used in cerates, plasters and ointments mostly.

Detaceum, U. S.—*Spermaceti.* A peculiar concrete fatty substance obtained from the sperm whale—physeter macrocephalus; color, white, translucent; consistence, hard, crystalline; odor and taste, none; melts at 122° F. Consists chiefly of cetin.

Used in ointments and cerates.

Petrolatum, U. S.—*Petroleum Ointment.* Sometimes known as "soft paraffin." A half-solid body, consisting of hydrocarbons, chiefly of the marsh gas series, viz.: Paraffins and olefines. A yellowish fat-like mass; melting point variable, owing somewhat to its origin, and ranging between 109° and 151° F. (See U. S. P. as to dispensing.) Insoluble in water and indifferent to the most powerful acids and alkalies. Distilled with the strongest oil of vitriol it remains intact. Readily soluble in warm alcohol, ether, oil of turpentine, olive oil, benzol, chloroform and bisulphide of carbon, and will not mix with water in any proportion.

## EMULSIONS.

The theory of emulsification is best illustrated by that natural and one of the most perfect of all emulsions—milk, which consists of numberless globules of butter surrounded by a thin covering of casein, a viscid matter, held in suspension in water. Hence, an emulsion is a liquid preparation holding in suspension oily or resinous liquids in water by gum or some viscid substance, the object sought being a minute division of the oil or fat into innumerable little globules surrounded with adhesive envelopes of acacia, mucilage, etc.;

these suspended in water, in a perfect emulsion, should show no tendency to recombine into fat, etc. The perfect emulsion can be diluted with water to any extent, and with substances dissolved in water; flavoring, etc., may be added to it, but fluids that contain alcohol can only be added when first diluted. The fact that it afterwards separates into two layers like cream, however, is no proof that it has been imperfectly made. It is an opaque mixture, and when perfect it should present the smooth, glistening appearance presented by cream. They are of a thick consistence, and may be divided into two classes, viz.:

1. *Natural emulsions*, existing in the milky juices of plants, milk of animals, yolk of egg, etc.

2. *Manufactured emulsions*, those produced artificially.

*Gum-resin emulsions* are prepared by reducing the gum-resin to a coarse powder and triturating with a little water till a smooth, even paste is produced, when the balance of the water is added, and the mixture is strained.

*Seed emulsions*, those made from the kernels or seeds of fruit, may be prepared in the same way by careful rubbing in a mortar.

Different methods are employed in making emulsions. Prof. Remington, however, gives two as most important. They are:

1. *The English method.* Here the emulsifying agent is mucilage, yolk of eggs, etc., to which small portions

of the oil and water are gradually and carefully added while stirring it thoroughly. Care should be taken not to add the oil and water too rapidly at the beginning.

2. *The Continental method* "has the great merit of never failing to produce a good emulsion if the proper proportions are used to form the nucleus and if the directions are strictly followed." To make an emulsion of this sort we take four parts of oil, two parts of water and one part of gum. The oil is first stirred up with the gum until the mixture is uniform, and then the water is added all at once and stirred in until emulsification takes place. Water may be added to the mixture without risk.

### ORGANIC DRUGS.

These are derived from the animal and vegetable kingdoms, and are such as musk and cantharides, sarsaparilla, etc. These drugs have been classified as follows:

1. Those drugs which contain no medicinal principle, but which contain and are valued mainly for the lignin, amyloids, cellulose, gum, sugars, or bland fixed oils, coloring matters, etc., which they contain. The most important have been classified as follows:

AMYGDALA DULCIS, U. S.—*Sweet Almond.* Seed of amygdalus communis, varety, dulcis, containing about 45 per cent. of fixed oils, protein compounds, mucilage, etc.

Officinal preparations: Mistura amygdalæ, syrupus amygdalæ.

ALTHÆA, U. S.—*Marshmallow.* The root of althæa officinalis; natural order, malvaceæ. It contains 37 per cent. of starch, with a large proportion of mucilage, together with asparagin and sugar.

*Uses.*—Demulcent; used in pill masses.

Officinal preparation: Syrupus altheaæ. It should always be prepared without the use of heat.

CETRARIA, U. S.—(*Iceland Moss*). A lichen containing from 65 to 70 per cent. of lichenin; natural order, lichenes. In pharmacy the entire plant of *Cetraria Islandica* Acharius. Lichenin is allied to starch, and swells up when soaked in water. Besides lichenin it contains cetraric acid, which gives it its bitter taste. It is demulcent and nutritive.

Officinal preparation: Decoctum cetrariæ.

CHONDRUS, U. S.—*Irish Moss. Chondrus crispus* Lyngbye, and *chondrus mammilosus* Greville; natural order, algæ; found growing in the Atlantic Ocean; contains no starch, but from 65 to 70 per cent. of a mucilaginous principle called carrageenin.

*Use.*—For making a sick diet jelly.

GOSSYPIUM, U. S.—*Cotton. Purified or absorbent cotton.* The hairs of the seed of *gossypium herbaceum* Linne, and of other species of gossypium, freed from fatty matter and adhering impurities; natural order, malvaceæ. It consists of cellulin in one of its purest forms.

Used for bandages, strainers, lint, etc.

Officinal preparation: Pyroxylinum.

TRITICUM, U. S.—*Couch Grass.* Rhizome of triticum repens Linne; natural order, graminaceæ. A solid body containing *triticin*, which resembles inulin, glucose, etc.

*Use.*—Diuretic.

Officinal preparation: Extractum tritici fluidum.

CYDONIUM, U. S.—*Quince Seed.* Seed of *cydonia vulgaris* Persoon; natural order, rosaceæ pomeæ. Contains 2 per cent. of a mucilage.

Officinal preparation: Mucilago cydonii.

SANTALUM RUBRUM, U. S.—*Red Saunder.* Wood of *Pterocarpus santalinus* Linne; natural order, leguminosæ papilionaceæ. Consists of santalic acid, pterocarpin and santol.

*Use.*—A coloring matter.

ULMUS, U. S.—*Elm* (*Slippery Elm*). Inner bark of *ulmus fulva* Michaux; natural order, urticaceæ ulmeæ. Contains a mucilage which, in an aqueous solution, may be precipitated by alcohol and lead acetate.

*Uses.*—In poultices; a demulcent.

Officinal preparation: Mucilago ulmi.

SASSAFRAS MEDULLA, U. S.—*Sassafras Pith* (pith of *sassafras officinalis* Nees; natural order, lauraceæ. Contains mucilage.

Officinal preparation: Mucilago sassafras medullæ.

LINUM, U. S.—*Flax Seed* (linseed). Seed of *linum usitatissimum* Linne; natural order, linaceæ. Contains mucilage, fixed oil, resin, sugar, wax, etc.

Used as a tea and in poultices.

PRUNUM, U. S.—*Prune.* Fruit of *prunus domestica* Linne; natural order, rosaceæ. Constituents: Malic acid, pectin, etc. The pulp is used as a laxative, also in confection of senna.

FICUS, U. S.—*Fig.* Fleshy receptacle of *ficus carica* Linne; natural order, urticaceæ artrocarpeæ. Contains sugar, gum, etc.

MANNA, U. S.—*Manna.* A concrete sugary exudation of *fraxinus ornus* Linne; natural order, oleaceæ. Contains 90 per cent. of mannit, a sweet principle found in other plants also.

*Uses.*—A laxative, and in infusum sennæ compositum.

HÆMATOXYLON, U. S.—*Hæmatoxylon* (logwood). Heartwood of *hæmatoxylon campechianum* Linne; natural order, leguminosæ, papilionaceæ. Contains hæmatoxylin, tannin and resin.

*Uses.*—An astringent and dye.

Officinal preparation: Extractum hæmatoxyli.

MALTUM, U. S.—*Malt.* Seed of *hordeum distichum* Linne, caused by artificial means to begin germination and then dried. Contains dextrin, diastase, sugar, starch, etc.

Officinal preparation: Extractum malti.

LYCOPODIUM, U. S.—*Lycopodium.* Spores of *Lycopodium clavatum* Linne, and other species of lycopodium; natural order, lycopodiaceæ. Contains 47 per cent. of fixed oil.

The unofficinal drugs of this group are:

| COMMON NAME. | BOTANIC NAME. | PART OF DRUG USED. |
|---|---|---|
| Adansonia. | Adansonia digitata. | Bark. |
| Adiantum. | Adiantum pedatum. | Frond. |
| Alkanet. | Alkanna tinc ori a | Root. |
| Borage. | Borago officinalis. | Herb. |
| Chicory. | Chicorium intybus. | Root. |
| Salep. | Differ'nt species orchis | Tubers. |
| Sesamum. | Sesamum indicum. | Leaves. |
| Tonka. | Dipterix odorata. | Seed. |
| Mullein. | Verbascum thapsus. | Leaves, root. |

DRUGS CONTAINING AROMATIC PRINCIPLES.

The vegetable drugs which constitute this group are valuable chiefly for their volatile oil. With one or two exceptions, their preparations are precipitated on the addition of water. Some of them, however, will dissolve in syrup, but the less sugar the water contains the less soluble they are.

ANSINUM, U. S.—*Anise.* Fruit of *Pimpinella Anisum* Linne; natural order, Umbelliferæ orthospermæ. Constituents, about 2 per cent. of volatile oil, fixed oil 3 per cent., mucilage, etc.

*Uses.*—Carminative and stimulant.

BUCHU, U. S.—*Buchu.*—Leaves of barosma betulina, bartling, barosma crenulata Hooker, and barosma serratifolia Willdenow; natural order, Rutaceæ diosmeæ. Contains volatine oil, resin, mucilage, a bitter principle, etc.

*Uses.*—Diuretic and stimulant.

Officinal preparation: Extractum buchu fluidum.

CALAMUS, U. S.—*Calamus* (*Sweet Flag*). Rhizome of acorus calamus Linne; natural order, araceæ. Contains a volatile oil of the terpene type, soft resin, acorin, etc.

Used in wine of rhubarb.

Officinal preparation: Extractum calami fluidum.

CARDAMOMUM, U. S.—*Cardamom.* Fruit of *Elettaria cardamomum* Maton; natural order, zingiberaceæ. A valuable aromatic; habitat of India Contains volatile oil, 5 per cent.; 10 per cent. of fixed oil, mucilage, starch, etc.

Officinal preparations: Tinctura cardamomi, tinctura cardamomi composita.

CASCARILLA, U. S.—*Cascarilla.* Bark of Croton eluteria Bennett; natural order, euphorbiaceæ. Constituents, about 1.5 per cent. volatile oil, cascarillin, 15 per cent. of resin, gum, pectin, etc.

*Uses.*—Tonic and stimulant.

CARUM—*Caraway.* Fruit of Carum carvi Linne; natural order, umbelliferæ. Contains volatile oil, about 5.5 per cent., a fixed oil, etc. It is a carminative and stimulant.

CHENOPODIUM, U. S.—*Chenopodium* (American wormseed). Fruit of Chenopodium ambrosoides Linne, varety, anthelminticum Gray; natural order, chenopodiaceæ. Contains volatile oil, a resin, etc.

*Use.*—Anthelmintic.

CINNAMOMUM.—*Cinnamon.* Inner bark of the

shoots of *Cinnamomum Zeylanicum* Breyne (Ceylon cinnamon), or bark of shoots of one or more species of cinnamomum: natural order, lauraceæ. Both Ceylon and Chinese cinnamon contain volatile oil, tannin, mucilage, etc.

Officinal preparation: Tinctura cinnamomi.

CARIOPHYLLUS, U. S.—*Cloves.* Unexpanded flowers of *Eugenia caryophyllatta* Thunburg; natural order, myrtaceæ. Contains about 17 per cent. of volatile oil, tannin, carophyllin, etc.

Used as an aromatic in three officinal preparations.

CORIANDRUM, U. S.—*Coriander.* Fruit of *Coriandrum sativum* Linne; natural order, umbelliferæ. Contains volatile oil and a fixed oil. It is used in the confection of senna.

CUBEBA, U. S.—*Cubeb.* Unripe fruit of cubeba officinalis Miquel; natural order, piperaceæ. Contains volatile oil, cubebin, cubebic acid, etc,

*Uses.*—Diuretic, stimulant and expectorant.

Officinal preparations: Extractum cubebæ fluidum, oleoresina cubebæ, trochisi cubebæ, tinctura cubeb.

EUCALYPTUS.—*Eucalyptus.* Leaves of *Eucalyptus globulus* Labillardiere; natural order, myrtaceæ. Contains volatile oil, resin, tannin, fatty acid, etc.

*Uses.*—The leaves, stimulant, febrifuge and astringent..

Officinal preparation: Extractum eucalypti fluidum.

FŒNICULUM, U. S.—*Fennel.* Fruit of Fœniculum

vulgare Goertner; natural order, umbelliferæ, orthospermæ. Contains volatile oil, fixed oil, etc.

Used in compound infusion of senna.

GAULTHERIA, U. S.—*Gaultheria* (Wintergreen). Leaves of Gaultheria procumbens Linne; natural order, ericaceæ. Contains volatile oil, ericolin, tannin, gum, etc.

*Uses.*—Aromatic and astringent.

ZINGIBER, U. S.—*Ginger*. The rhizome of *Zingiber officinalis* Roscoe; natural order, zingiberacæ. Contains volatile oil, resin, ginger, etc. Used in five

Officinal preparations: Extractum zingiberis fluidum, oleoresina zingiberis, syrupus zingiberis, tinctura zingiberis, trochisci zingiberis.

HEDEOMA, U. S.—*Hedeoma* (Pennyroyal). Leaves and tops of *Hedeoma pulegioides* Persoon; natural order, labiatæ. Contains volatile oil.

*Uses.*—Stimulant and aromatic.

ILLICIUM, U. S.—*Illicium* (Star anise). Fruit of *Illicium anisatum* Loureiro; natural order, magnoliaceæ. Containing volatile oil, resin and fixed oil.

*Uses.*—Source of most of commercial oil of anise.

LAVANDULA, U. S;—*Lavender*. Flowers of *Lavandula vera* De Candolle; natural order, labiatæ. Important constituent, volatile oil.

*Uses.*—In perfumery.

LIMONIS CORTEX, U. S.—*Lemon Peel*. Rind of fruit of *Citrus Limonum* Risso; natural order, aurantiaceæ. Contains volatile oil and hesperidin.

*Uses.*—For flavoring and coloring to spirit and syrup of lemon.

MACIS.—*Mace.* The arillus of the fruit of *Myristica fragrans* Houttuyn; natural order, myristicaceæ. Contains 70 per cent. of volatile oil, fixed oil and resin.

MAGNOLIA, U. S.—*Magnolia.* Bark of *Magnolia Glauca* Linne; *M. Accuminata* Linne, and *M. Tripetala* Linne; natural order, magnoliacæ. Contains volatile oil, resin, tannin and magnolin.

Rarely used. Tonic and diphoretic.

MARRUBIUM, U. S.—*Marrubium* (Hoarhound). Leaves and tops of *Marrubium vulgare* Linne; natural order, labiatæ. Contains volatile oil, resin and marrubiin.

*Uses.*—It is stimulant, tonic and expectorant.

MELISSA, U. S.—*Melissa* (Balm). Leaves and tops of *Melissa officinalis* Linne; natural order, labiatæ. Contains volatile oil, to which it owes its properties as a stimulant and carminative.

MYRISTICA, U. S.—*Nutmeg.* The kernel of the seed of *Myristica fragrans* Houttuyn; natural order, myristicaceæ. Contains volatile oil, fixed oil, starch, etc.

*Uses.*—In officinal preparations.

ORIGANUM, U. S.—*Origanum* (Wild Marjoram). Leaves and tops of *Origanum vulgare* Linne; natural order, labiat. Contains volatile oil, resin, etc.

AURANTII FLORES, U. S.—*Orange Flowers.* Partly expanded fresh flowers of *Citrus vulgaris* and *C. Aurantium* Risso: natural order, aurantiaceæ. Contains

volatile oil, and is used in preparing orange flower water and oil of neroli.

Officinal preparation: Aqua aurantii florum.

AURANTII CORTEX, U. S.--*Bitter Orange Peel.* Rind of the fruit of *Citrus vulgaris* Risso; natural order, aurantiaceæ. Contains volatile oil and hesperidin, and is used as a bitter tonic.

Officinal preparations: Extractum aurantii amari fluidum, tinctura aurantii amari.

AURANTII DULCIS CORTEX, U. S.—*Sweet Orange Peel.* Rind of the fruit of *Citrus aurantium* Risso; natural order, aurantiaceæ. Contains volatile oil and hesperidin, and is used as a flavor.

Officinal preparations: Syrupus aurantii, tinctura aurantii dulcis.

PIPER, U. S.—*Pepper* (Black Pepper.) Unripe fruit of *Piper nigrum* Linne; natural order, piperaceæ. Contains piperine, a feeble alkaloid, volatile oil and resin.

Used as a condiment.

Officinal preparation: Oleoresina piperis.

MENTHA PIPERITA, U. S.--*Peppermint.* Leaves and tops of *Mentha piperita* Linne, natural order, labiatæ. Its properties are due to its volatile oil, and it is used as an aromatic stimulant.

PIMENTA, U. S.—*Pimenta* (Allspice). Nearly ripe fruit of *Eugenia pimenta* De Candolle; natural order, myrtaceæ. It contains about 1½ per cent. volatile oil,

with tannin, fat, resin, gum, etc. Chiefly valuable for its oil.

ROSA CENTIFOLIA, U. S.—*Pale Rose.* Petals of *Rosa centifolia* Linne; natural order, rosaceæ. Contains volatile oil, mucilage, tannin, etc. Valuable mainly for its flavor.

Officinal preparation: Aquæ rosæ.

ROSA GALLICA, U. S.—*Red Rose.* Petals of *Rosa gallica* Linne; natural order, rosaceæ. It contains quercitrin, quercitannic acid, volatile oil, etc.

ROSMARINUS, U. S.—*Rosemary.* Leaves of *Rosmarinus officinalis* Linne; natural order, labiatæ. Owes its chief value to its volatile oil. It also contains resin, tannin and a bitter principle.

Used in perfumery.

CROCUS, U. S.—*Saffron.* The stigmas of *Crocus sativus* Linne; natural order, iridaceæ. Contains polychroit, volatile oil, fixed oil, etc.

Used chiefly for coloring, diaphoretic, anodyne and carminative.

Officinal preparation: Tinctura croci.

SALVIA, U. S.—*Salvia* (Sage). Leaves of *Salvia officinalis* Linne; natural order, labiatæ. Contains volatile oil, resin, tannin and salviol.

Used in infusion in sore mouth, etc. A condiment.

SAMBUCUS.—*Sambucus* (Elder). Flowers of *Sambucus Canadensis* Linne; natural order, caprifoliaceæ. Contains volatile oil, resin, mucilage, etc. Their vir-

tues may be extracted by a menstruum composed of water and diluted alcohol.

SASSAFRAS, U. S.—*Sassafras.* Bark of the root of *Sassafras officinalis* Nees; natural order, lauraceæ. Contains volatile oil, sassafrid, tannin, resin, etc.

Used chiefly on account of its aromatic oil, and enters into three officinal preparations of sarsaparilla; also as a tea to purify the blood.

SCUTELLARIA, U. S.—*Scutellaria* (Skullcap). *Scutellaria lateriflora* Linne; natural order, labiatæ. Contains volatile oil, bitter principle and tannin.

*Uses.*—Tonic and antispasmodic.

Officinal preparation: Extractum scutellaria fluidum.

MENTHA VIRIDIS.—*Spearmint.* Leaves and tops of *Mentha viridis* Linne; natural order, labiatæ. Contains nothing, except a volatile oil, important.

SUMBUL, U. S.—*Sumbul.* Root of *Ferula sumbul* Hooker filius; natural order, umbelliferæ orthospermæ. Contains volatile oil and a resinous compound with musky odor, angelic acid, etc.

Officinal preparation: Tinctura sumbul.

TANACETUM, U. S.—*Tansy.* Leaves and tops of *Tanacetum vulgare* Linne; natural order, compositæ. Contains bitter principle, tanacetin, volatile oil, resin, tannin, etc.

VALERIANA, U. S.—*Valerian.* Rhizome and rootlets of *Valeriana officinalis* Linne; natural order, valerianaceæ. Contains volatile oil (about 1 per cent.), resin, starch, valerianic acid, etc. It is a nervine.

Officinal preparations: Abstractum valerianæ, extractum valerianæ fluidum, tinctura valerianæ, tinctura valerianæ ammoniata.

VANILLA, U. S.—*Vanilla.* Fruit of *Vanilla planifolia* Andrews; natural order, orchidaceæ. Contains 10 per cent. of fixed oil, resin, sugar, vanillin, with a trace of a volatile oil, etc.

*Use.*—A flavor.

Officinal preparation: Tinctura vanillæ.

The unofficinal drugs of this group have been classified as follows:

UNOFFICINAL DRUGS—Group 2 (Hallberg).

| COMMON NAME. | BOTANIC NAME. | PART USED. | CONSTITUENTS. |
|---|---|---|---|
| Achillea (Yarrow) | Achillea Millifolium. | Herb. | Volatile oil, achillein, resin, tannin, etc. |
| Angelica Americana | Archangelica atropurpurea. | Root. | Vol. oil, vol. acids, resin. |
| Angelica ...... | Archangelica officinalis. | Root, | Same as above. |
| Apium ......... | Apium graveolens. | Fruit. | Vol. oil, fixed oil, etc |
| Artemisia .... | Artemisia vulgaris. | Herb. | Vol. oil, bitter principle. |
| Asarum ........ | Asarum Canadense. | R'zome. | Vol. oil, 3 per ct. resin, coloring matter |
| Benzoin ........ | Benzoinum odoriferum. | Bark & fruit. | Vol. oil, tannin. |
| Bush ............ | .............................. | Fruit. | .............................. |
| Canella......... | Canella alba. | Bark. | Vol, oil, resin, bitter principle. |
| Cataria......... | Nepeta cataria. | Herb. | Vol, oil, bitter principle. |
| Comptonia... | Comptonia asplenifolia. | Leaves. | Vol. oil, resin, tannin, alkaloid. |
| Cotula (Mayweed) ........ | Maruta Cotula. | Herb. | Vol. oil, anthemic & valerianic acids, acrid fixed oil. |

## UNOFFICINAL DRUGS—Group 2 (Hallberg).

| COMMON NAME. | BOTANIC NAME. | PART USED. | CONSTITUENTS. |
|---|---|---|---|
| Erigeron (Fleabane) | Erigeron Canadensis. | Herb. | Vol. oil, bitter principle. |
| Eriodictyon.. | Eriodictyon Californicum, | Leaves. | Vol oil resin. |
| Glechoma.... | Glechoma hederacea | Herb. | Vol. oil, bitter principle. |
| Golden Rod.. | Solidago odora. | Herb. | Vol. oil. |
| Hyssop......... | Hyssopus officinalis. | Herb. | Vol. oil, bitter principle, tannin. |
| Imperatoria. | Imperatoria ostrutheum. | Root. | Vol. oil, ¾ per cent. imperatorin. |
| Iris (orris) .... | Iris florentina. | R'zome. | Vol. oil, resin; bitter extractive, starch. |
| Juniper (Virginia) | Juniperus Virginiana. | Twigs. | Vol. oil, resin. |
| Laurel ......... | Laurus nobilis. | Leaves. | Vol. oil, bitter principle. |
| Levisticum (Lovage) | Levisticum officinale | Root. | Vol. oil, bitter extractive, resins. |
| Marjoram.... | Organum marjorana. | Herb. | Vol. oil. |
| Micromeria .. | Micromeria Douglassii. | Herb. | Vol. oil. |
| Parsley......... | Petroselinum sativum. | Root & seed. | Vol. oil and apiin. |
| Pimpernel ... | Pimpinella saxifraga | | |
| Rhus (aromatic) ...... | Rhus aromatica. | Root. | Vol. oil, resin, tannin. |
| Sandalwood.. | Santalum album. | Wood.. | Vol. oil, ¼ per cent. resin. |
| Sarsaparilla (false).. ...... | Aralia nudicaulis. | R'zome. | ................................ |
| Spikenard (American) | Aralia racemosa. | R'zome & root. | Vol. oil, resin. |
| Thyme ......... | Thymus vulgaris. | Herb. | Vol. oil, resin. |
| Tumeric........ | Curcuma longa. | R'zome. | Vol. oil, pungent resin. |
| Wintera........ | Drimys winteri. | Bark. | Vol. oil, tannin, pungent resin. |
| Xanthoxylum (Prickly ash) | Xanthoylum fraxineum. | Fruit & bark. | Vol. oil, resin. |
| Zedoaria ...... | Curcuma zedoaria. | R'zome. | Vol oil, pungent resin. |

There are other drugs which might be classified under this head, but they described further on.

DRUGS OF A RESINOUS CHARACTER.

ABSINTHIUM, U. S. — *Absinthium* (Wormwood). Leaves and tops of *Artemisia absinthium* Linne; natural order, compositæ. Contains volatile oil 1 per cent. (mostly absinthol), absinthin, tannin, resin, etc.

Used in the preparation of aromatic wine, etc.

ARNICÆ FLORES and ARNICA RADIX, U. S.—*Arnica Flowers and Root.* Flower heads and rhizome and rootlets of *Arnica montana* Linne; natural order, compositæ. Contain volatile oil, arnicin, acrid resin, tannin, etc.

Officinal preparations: Tinctura arnicæ florum, extractum arnicæ radicis, emplastrum arnicæ, extractum arnicæ radicis fluidum, tinctura arnicæ radicis.

ASCLEPIAS, U. S.—*Asclepias* (Pleurisy Root). Root of *Asclepias tuberosa* Linne; natural order, asclepiadaceæ. Contains resins, volatile principle, tannin, mucilage, etc.

ASPIDIUM, U. S.—*Aspidium* (Male Fern). Rhizome of *Aspidium filixmas* Schwartz, and of *Aspidium marginale* Willdenow; natural order, filices. Contains *filicic* acid, filix red, filitannic acid, fixed oil, etc.

Officinal preparation: Oleoresina aspidii.

*Uses.*—"As a tænifuge in the form of oleoresin."

AZEDARACH, U. S.—*Azedarach.* Bark of the root of *Melia azedarach* Linne; natural order, meliaceæ.

Contains a bitter resin, to exhaust which alcohol is a good menstruum. It is an anthelmintic and an emetic. Dose 15 to 30 grains.

BRAYERA, U. S.—*Brayera.* Female inflorescence of *Brayera anthelmintica* Kunth. Contains bitter kosin resin, tasteless resin, tannin, gum, etc.

Used as an anthelmenitic.

Officinal preparations: Infusum brayeræ, extractum brayeræ fluidum.

CANNABIS INDICA, U. S.—*Indian Cannabis* (Indian Hemp). Flowering tops of the female plant of *Cannabis sativa* Linne; natural order, urticaceæ cannabineæ; grown in the East Indies. Contains resin, cannabinine, tetanocannabinine, volatile oil, etc. Alcohol is the best menstruum to exhaust its virtues. It is an anodyne and nervine.

Officinal preparations: Extractum cannabis Indicæ, extractum cannabis Indicæ fluidum. tinctura cannabis Indicæ.

CANNABIS AMERICANA, U. S.—*American cannabis. Cannabis sativa* Linne; natural order, Urticaceæ cannabineæ; grown in the southern part of the United States. Contains resins and trace of volatile oil.

Used like cannabis Indica.

CAULOPHYLLUM, U. S.—*Blue Cohosh.* Rhizome and rootlets of *Caulophyllum thalictroides;* natural order, berberidaceæ. Contains saponin, resin, gum, etc. Alcohol is the best menstruum to exhaust its virtues with. It is an antispasmodic and emmenagogue.

ANTHEMIS, U. S.—*Anthemis* (Chamomile). Flower heads of *Anthemis nobilis* Linne; natural order compositæ. Contains volatile oil and a bitter principle, to which its virtues are due.

Used in infusion as a tonic.

CIMICIFUGA, U. S.—*Cimicifuga* (Black Snake-root). Rhizome and rootlets of *cimcifugæ racemosa* Elliott; natural order, ranunculaceæ. Contains resin, an acrid principle, a peculiar acid, tannin, gum, etc.

*Uses.*—Sedative and alterative. Dose, 30 grains.

Officinal preparations: Extractum cimicifugæ fluidum, tinctura cimicifugæ.

GOSSYPII RADICIS CORTEX, U. S.—*Cotton Root Bark.* Bark of the root of *Gossypium herbaceum* Linne, and other species of gossypium; natural order, malvaceæ. Contains resin, fixed oil, tannin, starch, etc.

Officinal preparation: Extractum gossypii radicis fluidum. Also used in decoction and infusion. Dose, 60 grains.

CYPRIPEDIUM, U. S.—*Cypripedium* (Ladies' Slipper). Rhizome and rootlets of *Cypripedium pubescens* Willdenow, and C. parviflorum by Salisbury; natural order, orchidaceæ. Contains resins, an acrid principle, volatile oil, tannin, etc.

*Uses.*—Stimulant and diaphoretic. Dose, 15 grains.

Officinal preparation: Extractum cypripedii fluidum.

FRANGULA, U. S.—*Frangula.* Bark of *Rhamnus frangula* Linne. Should be at least one year old before

using. Natural order, rhamnaceæ. Contains resin, bitter principle, emodin, frangulin, tannin, etc.

*Uses.*—When fresh, an emetic; when old, a purgative, diuretic and tonic. Dose, 20 grains.

Officinal preparation: Extractum frangulæ fluidum.

ALLIUM, U. S.—*Garlic.* Bulb of *Allium sativum* Linne; natural order, liliaceæ. Contains ¼ per cent. volatile oil, mucilage, etc. The volatile oil is the active principle.

*Uses.*—Stimulant, expectorant and vesicant.

Officinal preparation: Syrupus allii.

GRINDELIA, U. S.—*Grindelia.* Leaves and flowering tops of *Grindelia robusta* Nuttall; natural order, compositæ. Contains volatile oil, a bitter and resinous principle, etc.

Officinal preparation: Extractum grindeliæ fluidum.

GUAIACI LIGNUM, U. S.—*Guaiacum Wood* (Lignum Vitæ). Heart-wood of *Guaicum officinale* Linne, and of *Guaiacum sanctum* Linne; natural order, zugophyllaceæ. Its virtues are due to the resin it contains.

*Uses.*—Alterative, anti-rheumatic and diaphoretic. Dose, 30 to 60 grains.

HAMAMELIS, U. S.—*Hamamelis* (Witch Hazel). Leaves of *Hamamelis Virginica* Linne; natural order, hamamelaceæ. The leaves should be collected green in autumn. Contains tannin, bitter extractive, mucilage, etc.

*Uses.*—Astringent and sedative. Dose, 60 grains.

Officinal preparation: Extractum hamamelidis fluidum.

INULA, U. S.—*Inula* (Elecampane). Root of *Inula helenium* Linne; natural order, compositæ. Contains inulin and resin, volatile oil, etc.

IRIS, U. S.—*Iris* (Blue Flag). Rhizome and rootlets of *Iris versicolor*; natural order, iridaceæ. Contains bitter resin, volatile oil, etc. Dose, 15 grains.

JALAP, U. S.—*Jalapa.* Tuberous root of *Exogonium purga*; natural order, convolvulaceæ. Constituents: Resins, about 20 per cent. Dose, 10 to 20 grains.

JUNIPERUS, U. S.—*Juniper.* Fruit of *Juniperus communis*; natural order, conifera. Constituents: Volatile oil, resins and sugar.

KAMALA, U. S.—*Kamala.* Hairs and glands from capsules of *Mallotus Phillipinensis* or *Rottlera tinctoria*; natural order, euphorbiaceæ. Constituents: Resins, about 75 per cent. coloring matter, etc. Dose, 1 to 3 drams.

LAPPA, U. S.—*Lappa* (Burdock). Root of *Lappa officinalis*; natural order, compositæ. Constituents: Inulin, bitter extractive, mucilage and resin.

LUPULIN, U. S.—*Lupulinum.* Glandular powder obtained from strobiles of *Humulus lupulus*; natural order, urticaceæ. Constituents: Volatile oil, resin and acid.

MARRUBIUM, U. S.—*Marrubium* (Hoarhound.) Leaves and tops of *Marrubium vulgare*; natural or-

der, labiatæ. Constituents: Volatile oil, resin and a bitter principle.

Matico, U. S.—*Matico.* Leaves of *Artanthe elongata*; natural order, piperaceæ. Constituents: Volatile oil, resin, artanthic acid and tannin.

Matricaria, U. S.—*Matricaria* (German Chamomile). Flower heads of *Matricaria chamomilla*; natural order, compositæ. Constituents: Volatile oil, anthemic acid, anthemidin and a bitter extractive.

Mezereum, U. S.—*Mezereum.* Bark of *Daphne mezereum* Linne and of other species of *daphne*; natural order, thymelaceæ. Contains soft acrid resin, daphnin and volatile principle.

Officinal preparations: Extractum mezerei fluidum, extractum mezerei, ungnentum mezerei.

Phytolaccæ Bacca, U. S.—*Phytolacca Berry* (Pokeberry). Fruit of *Phytolacca decandra*; natural order, phytolaccaceæ. Contains acrid principle, sugar, gum, etc.

Phitolacca Radix, U. S.—*Phytolacca Root* (Poke Root). Root of *Phytolacca decandra* Linne; natural order, phytolaccaceæ. Contains acrid principle, resin, tannin, etc.

Podophyllum, U. S.—*Podophyllum* (May Apple). Rhizome and rootlets of *Podophyllum peltatum* Linne; natural order, berberidaceæ. Contains picropodophyllin, podophyllotoxin, podophyllinic acid, resins, etc. It is a cathartic.

Officinal preparations: Abstractum podophylli, extractum podophyli fluidum. resina podophyli.

PULSATILLA, U. S.—*Pulsatilla.* Herb of *Anemone pulsatilla* and of *A. patens* and *A. pratenses* Linne; variety, *nuttalliana* Gray; natural order, ranunculaceæ. This drug should be collected soon after flowering, and after drying carefully it should be well preserved and must not be kept over one year. Contains an acrid, odorous resin, gum, etc.

PEPO, U. S.—*Pumpkin Seed.* Seeds of *Cucurbita pepo* Linne; natural order, cucurbitaceæ. Contains fixed oil, acrid resin, etc.

Used as a tænifuge.

PYRETHRUM, U. S.—*Pyrethrum* (Pellitory). Root of *Anacyclus pyrethrum* De Candolle; natural order, compositæ. Contains acrid resin, fixed oils, bitter principle, etc.

Officinal preparation: Tinctura pyrethri.

SABINA, U. S.—*Savine.* Tops of *Juniperus sabina* Linne; natural order, coniferæ. Contains volatile oil, resin, tannin, etc.

Officinal preparation: Extractum sabinæ fluidum.

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## Questions on Lecture VII.

1. To what group of oils does oil of beechnut belong?
2. With what oil is castile soap made?
3. What are the principal non-odorous solid fats?
4. What drug contains 65 to 70 per cent. of lichenin?
5. For what are drugs containing an aromatic principle chiefly valued?

6. Give uses of chenopodium.
7. Give the pharmaceutical name of cloves.
8. Give the natural order of peppermint.
9. Give the constituents of canella.
10. What part of grindelia robusta is used in pharmacy?

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## Answers to Questions on Lecture VI.

1. Starch and cellulin.
2. From the vegetable kingdom.
4. By distillation.
4. It causes it to fulminate violently.
5. Ecbalium elaterium.
6. Natural mixtures of gum and resin.
7. 60 per cent.
8. Of 80 to 90.
9. Mixtures.
10. It is expressed from lard at a low temperature.

# PHARMACY.

## Lecture VIII.

DRUGS OF A RESINOUS CHARACTER—*Continued.*

SERPENTARIA, U. S.—*Serpentaria* (Virginia Snake Root). Rhizome and rootlets of *Aristolochia Serpentaria* Linne, and *A. reticulasa* Nuttall; natural order, aristolochiaceæ. Contains (fresh) 1 per cent. volatile oil, bitter principle, starch, etc.

Officinal preparations: Extractum serpentariæ fluidum, tinctura serpentariæ.

STILLINGIA, U. S.—*Stillingia* (Queen's Root). Root of *Styllingia sylvatica* Linne; natural order, euphorbiaceæ. Contains acrid resin, fixed oil starch, etc,

Used as an alterative.

Officinal preparation: Extractum stillingiæ fluidum.

THUJA, U. S.—*Thuja* (Arbor Vitæ). Fresh tops of *Thuja occidentalis;* natural order, coniferæ. Contains volatile oil, thujin, pinipicrin and resin.

*Uses.*—Diuretic and stimulant.

XANTHOXYLUM, U. S.—*Xanthoxylum* (Prickly Ash). Bark of *Xanthoxylum fraxineum* Willdenow,

and of *X. Carolinianum* Lambert: natural order, rutaceæ Xanthoxyleæ. Contains resin, bitter principle, tannin.

*Uses.*—Sialagogue. stimulant and alterative.

Officinal preparation : Extractum xanthoxyli fluidum.

Other drugs which may be classed under this head and readily recognized, such as rosemary, viola tricolor, buchu. etc., and are described elsewhere.

UNOFFICINAL DRUGS OF THIS GROUP (Hallberg).

| COMMON NAME. | BOTANIC NAME. | PART USED. | CONSTITUENTS. |
|---|---|---|---|
| Actæa. | Actæa spicata. | Root. | Acrid principle. |
| Aletris. | Aletris farinosa. | R'zome. | Bitter principle. |
| Apocynum (Dogsbane) | Apocynum androsæmifolium. | R'zome and root. | Bitter principle, resin, etc. |
| Arum. | Arisæma triphyllum. | Leaves | Volatile, acrid principle |
| Bela. | Aegle Marmelos. | Fruit. | Bitter principle, volatile oil, tannin. |
| Cascara sagrada. | Rhamnus purshiana. | Bark. | Resins, tannin, etc. |
| Chelone. | Chelone glabra. | Herb. | Bitter principle. |
| Collinsonia. | Collinsonia Canadensis. | R'zome and root. | Bitter resinous matter. |
| Colt's foot. | Tussilago farfara. | Herb. | Bitter principle, tannin, mucilage. |
| Damiana. | Turnera microphylla | Leaves. | Bitter principle, volatile oil, resin. |
| Dioscorea. | Dioscorea Villosa. | R'zome. | Acrid principle, resin. |
| Dracontium. | Symplocarpus fœtidus. | R'zome. | Acrid principle, resin. |
| Gnaphalium. | Gnaphalium polycephalum. | Herb. | Bitter principle, volatile oil. |
| Helianthemum. | Helianthemum Canadense. | Herb. | Bitter principle, tannin. |
| Heracleum. | Heracleum lanatum. | Roots, leaves & fruit. | Acrid principle, resin and volatile oil. |
| Hypericum. | Hypericum perforatum. | Herb. | Resin, coloring matter, tannin. |
| Leonurus. | Leonurus cardiaca. | Herb. | Bitter principle, vol. oil |

| COMMON NAME. | BOTANIC NAME. | PART USED | CONSTITUENTS. |
|---|---|---|---|
| Liatris. | Liatris spicata and other species. | Tuber. | Resinous matter, volatile oil. |
| Lycopus. | Lycopus Virginicus. | Herb. | Bitter principle, volatile oil. |
| Menyanthes. | Menyanthes trifoliata | Leaves. | Acrid principle, Menyanthin. |
| Milkweed. | Asclepias cornuti. | R'zome. | Bitter principle, asclepidin, resin, tannin. |
| Myrica. | Myrca cerifera. | Bark. | Acrid resin, myrycinic acid. |
| Nymphæa. | Nymphœ odorata. | R'zome. | Bitter principle, mucilage, tannin. |
| Panax (Ginseng). | Panax quinquefolium | Root. | Resin, panaquilon. |
| Ricinus. | Ricinus communus. | Seed. | Acrid principle, fixed oil. |
| Sabbatia. | Sabbatia angularis and other species of sabbatia. | Herb. | Bitter principle and erythrocentaurin. |
| Senecio (Life Root). | Senecio Aureus. | Herb & root. | Bitter acrid principle and tannin |
| Silphium. | Silphium laciniatum and other species. | Root. | Resins, volatile oil. |
| Trillium. | Trillium erectum and other species. | R'zome. | Acrid principle, resin etc. |
| Triosteum. | Triosteum perfoliatum | R'zome and root. | Bitter principle, etc. |
| Viscum. | Viscum album. | Herb. | Bitter resin, salts and fixed oil. |

## VEGETABLE ASTRINGENT DRUGS.

Their astringent principles are mainly owing to tannic or gallic acid, and sometimes both. The mucilage present in some renders them both demulcent and astringent.

CASTANEA, U. S.—*Castanea* (Chestnut). Leaves of *Castanea vesca* Linne; natural order, cupuliferæ. Should be collected in September or October while still green. Contains tannic acid, mucilage, resin, etc.

Officinal preparation: Fluid extract of castanea.

Catechu, U. S.—*Catechu.* Extract prepared from the wood of *Acacia catechu* Willdenow; natural order leguminosæ mimoseæ. Contains catechutannic acid, catechin, catechol, etc.

Officinal preparations: Tinctura catechu composita, trochisci catechu.

Chrry, Wild (see Group 6).

Geranium, U. S.—*Geranium* (Cranesbill), Rhizome of *Geranium maculatum* Linne; natural order, geraniaceæ. Contains tannic acid, starch, pectin, etc.

Officinal preparation: Extractum geranii fluidum.

Krameria, U. S.—*Krameria* (Rhatany). Root of *Krameria triandra* Ruiz et Pavon, and of *Krameria tomentosa* St. Hilaire; natural order, polygalaceæ kramericæ. Contains kramero-tannic acid, starch, gum, etc.

Officinal preparations: Extractum krameriæ, extractum krameriæ fluidum, tinctura kramariæ.

Galla, U. S.—*Nutgall.* Excrescences on *Quercus lusitanica* Webb; variety, *infectoria* DeCandolle; natural order, cupuliferæ. Caused by the punctures and deposited ova of *Cynips gallæ* tinctoria Olivier; class, *Insecta;* order, *Hymenoptera.*

Hematoxylin (see Group 1).

Hamamelis and Matico (See Group 3).

Quercus Alba, U. S.—*White Oak.* Bark of *Quercus alba* Linne; natural order, cupuliferæ. Contains tannin. Used mainly for tanning leather.

Pomegranate (see Group 7).

Prinos, U. S.—*Black Alder.* Bark of *Prinos ver-*

*ticillatus* Linne, *Ilex verticillata* Grey; natural order, aquifoliaceæ. Contains resin, tannin, etc.

RUBUS, U. S.—*Blackberry.* Bark of root *Rubus villosus* Aiton, *R. Canadensis* Linne, *R. trivialis* Michaux; natural order, rosaceæ. Contains tannin 10 per cent.

Officinal preparations: Extractum rubi fluidum, syrupus rubi. Used in decoction and infusion.

RUMEX, U. S.—*Rumex* (Yellow Dock). Root of *Rumex crispus* Linne; natural order, polygonaceæ. Constituents, tannin, chrysophan, chrysophanic acid mucilage.

Officinal preparation: Extract rumicis fluidum.

UNOFFICINAL DRUGS (Hallberg).

| COMMON NAME. | BOTANICAL NAME. | PART USED. | CONSTITUENTS. |
|---|---|---|---|
| Agrimonia. | Agrimonia Eupatoria | Herb. | Tannin. |
| Alder. | Alnus Serrulata. | Bark. | Tannin. |
| Areca. | Areca Catechu. | Seed. | Tannin. |
| Avens. | Geum Rivale. | R'zome. | Tannin, bitter principle |
| Bistort. | Polygonum Bistorta. | R'zome. | Tannin, etc. |
| Comfrey. | Symphytum off. | Root. | Mucilage, tannin. |
| Dispyros. | Diospyros Virginiana. | Fruit & bark. | Tannin, sugar, etc. |
| Hepatica. | Hepatica Triloba and Hepatica Acutiloba | Herb. | Tannin, mucilage. |
| Heuchera. | Heuchera Americanis. | Herb. | Tannin. |
| Oenotheria. | Oenothera Biennis. | Herb. | Tannin, mucilage. |
| Plantain | Plantago Lancifola, " major. | Herb. | Tannin and bitter principle. |
| Pulmonaria | Pulmonaria off. | Herb, | Tannin, mucilage, resin. |
| Spiræa. | Spiræa Tomentosa. | Flowery tops. | Tannin and bitter principle. |
| Statice. | Statica Limonium, var. Carolinianum. | Root. | Tannin, mucilage. |
| Sumach. | Rhus Glabra | Bark. | Tannin, resinous matter |
| Tormentil. | Potentilla Tormentilla. | R'zome. | Tannin, kinovic acid. |

## THE REFRIGERANT DRUGS

include those whose virtues chiefly depend on the presence of citric, malic and tartaric acids. Many of them possess laxative properties.

CASSIA FISTULA, U. S.—*Cassia Fistula.* Natural order leguminosæ. Constituents, sugar, mucilage, pectin, fruit acids.

Preparation: Confectio sennæ.

LEMON JUICE, U. S.—*Limonis Succus.* Fresh juice of ripe fruit of *Citrus limonum*: natural order, aurantiaceæ. Constituents, citric acid, about 10 per cent.; also, malic acid and gum.

Preparations: Mistura potassii citratis, syrup limonis.

Lemon juice becomes unfit for use by age. It may be preserved by precipitating the gum by the addition of half its weight of alcohol, heating the clear portion to drive off the alcohol, and bottling while hot.

RASPBERRY, U. S.—*Rubus Idæus.* Fruit of *Rubus idæus*; natural order, rosaceæ. Constituents, volatile oil, citric acid, malic acid, pectin, glucose, coloring matter.

Preparation: Syrupus rubi idæi. In preparing this syrup the crushed berries should be permitted to stand twenty-four hours in order that they may undergo a slight fermentation; the juice is then expressed, heated to boiling point to coagulate albuminous matter, strained, and sugar dissolved in it by aid of heat.

RHUS GLABRA, U. S.—*Rhus Glabra* (Smooth Sumach). Fruit of *Rhus Glabra*; natural order, anacar-

diaceæ. Constituents, acid calcium and potassium malatas, tannin, coloring matter.

Preparation: Extractum rhois glabræ fluidum.

TAMARIND, U. S.—*Tamarindus.* Preserved pulp of fruit of *Tamarindus Indica;* natural order, leguminosæ. Constituents, citrates, malates, tartrates, acetates, sugar, pectin, tannin.

Preparation: Confectio sennæ.

### GLUCOSIDAL DRUGS

include those whose virtues depend upon the presence of glucosides aud neutral principles, or on peculiar organic acids. The term glucoside is applied to those organic principles which are readily resolvable into glucose and another organic principle, either by action of mineral acids, of alkalies, or of ferments. Glucosides are frequently associated with resins, oil, alkaloids and bitter principles. They possess either neutral or acid properties, and occasionally form salts; few are soluble in water, but the greater number are readily soluble in alcohol.

### OFFICINAL GLUCOSIDES.

CHRYSAROBIN, U. S.—*Chrysarobinum.* Improperly called chrysophanic acid. Extracted from a substance found in the wood of andira araroba aguiar; natural order, leguminosæ papilionaceæ.

PICROTOXIN, U. S. — *Picrotoxinum.* A neutral principle prepared from the seed *Anamirta paniculata* Colebrooke; natural order, menispernaceæ.

SALICIN, U. S.—*Salicinum.* A neutral principle from the bark of *Salix helix* and other species of salix; natural order, salicaceæ.

SANTONIN, U. S.—*Santoninum.* A neutral principle prepared from *Artemisia maritima;* natural order, compositæ; by some claimed to be an acid, forming salts with such alkalies as sodium, etc.

Among certain drugs contained in the glucosidal group are a few possessing peculiar characteristics. They contain two or more complex principles, and are classed by some authors as reactionary drugs. Among this group are the following officinal drugs:

BITTER ALMOND, U. S.—*Amygdala Amara.* Seed of *Amygdalus communis;* natural order, rosaceæ. Constituents, fixed oil about 40 per cent., amygdalin, emulsin, mucilage, sugar, etc.

Preparation: Syrupus amygdalæ.

WILD CHERRY, U. S.—*Prunus Virginiana.* Bark of *Prunus serotina;* natural order, rosaceæ. Constituents, bitter principle, tannin, amygdalin and emulsin.

Preparations: Extractum pruni Virginianæ fluidum, infusum pruni Virginianæ, syrupus pruni Virginianæ.

BLACK MUSTARD, U. S.—*Sinapis Nigra.* Seed of *Sinapis nigra;* natural order, cruciferæ. Constituents, fixed oil, myrosin, sinigrin. Under the influence of myrosin and water the myronate potassa is converted into a volatile oil.

WHITE MUSTARD, U. S.—*Sinapis Alba.* Seed of *Sinapis alba;* natural order, cruciferæ. Constituents,

fixed oil, sinalbin and myrosin, giving rise to volatile oil. For further information the student is referred to Parrish's Pharmacy.

GLUCOSIDAL DRUGS.

ALOES, U. S.—*Aloe.* Inspissated juice of leaves of *Aloe Socotrina ;* natural order, liliaceæ. Constituents, aloin, resin, volatile oil.

Preparations: Aloe purificata, extractum aloes aquosum, extractum colocynthidis comp., pilulæ aloes, pilulæ aloes et asafœtida, pilulæ aloes et ferri, pilulæ aloes et mastiches, pilulæ rhei comp., tincturæ aloes, tincturæ aloes et myrrhæ, tincturæ benzoini comp., vinum aloes.

Three different kinds of aloes occur in commerce, viz.; Barbadoes, Cape and Socotrine.

APOCYNUM, U. S.—*Apocynum.* Root of *Apocynum cannabinum;* natural order, apocynaceæ. Constituents, apocynin, apocynein, tannin and bittter extractive.

ARAROBA—Goa powder. Powder obtained from cavities of *Andira araroba;* natural order, leguminosæ. Constituents, resin, gum, chrysarobin.

Preparations: chrysarobinum, unguentum chrysarobini.

BRYONIA, U. S.—*Bryonia.* Root of *Bryonia alba* and *Bryonia dioica:* natural order, cucurbitaceæ. Constituent, bryonin.

Preparation: Tinctura bryoniæ.

CALENDULA, U. S.—*Calendula.* Fresh flowering

herb of *Calendula officinalis;* natural order, compositæ. Constituents, volatile oil, calendulin, bitter principle.

Preparation: Tinctura calendulæ.

CALUMBA, U. S.—*Columbo.* Root of *Jateorrhiza calumba;* natural order, menispermaceæ. Constituents, colombin, berberine, colombic acid.

Preparation: Extractum calumbæ fluidum. tinctura calumbæ.

CAPSICUM, U. S.—*Capsicum.* Fruit of *Capsicum fastigiatum;* natural order, solanaceæ. Constituents, ents, volatile oil, capsaicin, resin, etc.

Preparation: Extractum capsici fluidum, oleoresina capsici, tinctura capsici.

CHIMAPHILA, U.S.—*Chimaphila Pipsissewa.* Leaves of *Chimaphila umbellata* Nuttall; natural order, ericaceæ. Constituents, chimaphilin, arbutin, ericolin, urson, tannin, etc.

Preparation: Extractum chimaphilæ fluidum.

CHIRATA, U. S.—*Chirata.* Entire plant of *Ophelia chirata;* natural order, gentianaceæ. Constituents, chiratin and ophelic acid.

Preparations: Extractum chiratæ fluidum, tinctura chiratæ.

COLOCYNTH, U. S.—*Colocynthis.* Fruit of *Citrullus colocynthis;* natural order, cucurbitaceæ. Constituents, colocynthin, resin, fixed oil, gum.

Preparation: Extractum colocynthidis, extractum colocynthidis comp.

CORNUS, U. S.—*Cornus.* Bark of root of *Cornus Florida;* natural order, cornaceæ. Constituents, cornin, tannin, resin and gum.

Preparation: Extractum cornus fluidum.

DULCAMARA, U. S. —*Dulcamara* (Bittersweet). Young branches of *Solanum dulcamara;* natural order, solanaceæ. Constituents, resin, dulcamarin, solanine, gum, wax, fat, etc.

DIGITALIS, U. S.—*Fox Glove.* Leaves of *Digitalis purpurea;* natural order, scrophulariaceæ. Constituents, digitalin, digitoxin and resin.

Preparations: Abstractum digitalis, infusion digitalis, extractum digitalis fluidum, extractum digitalis, tinctura digitalis.

The so-called digitalin of commerce is a mixture of the various active principles, it at one time being considered an alkaloid, but now said to be a mere mixture.

ERGOT, U. S.—*Ergota.* The sclerotium of *Claviceps purpurea;* natural order, fungi, replacing the grain of common rye. Constituents, sclerotic acid, scleromicin, fixed oil about 25 per cent.

Preparations: Extractum ergotæ fluidum, extractum ergotæ, vinum ergotæ.

Doubts exist as to what principle ergot owes its medicinal value, but it is conceded that whether it be glucosidal, alkaloidal, or both, or whether it owes its value to a peculiar acid, the desirable principles are more soluble in water than in alcohol, and preparations

made with aqueous menstrua are preferable to those of alcoholic menstrua.

EUONYMUS, U. S.—*Wahoo.* Bark of *Euonymus atropurpureus;* natural order, celastraceæ. Constituents, euonymin, resin, asparagin, euonic acid, starch and pectin.

Preparation: Extractum euonymi.

EUPATORIUM, U. S.—*Boneset.* Leaves of flowering tops of *Eupatorium perfoliatum;* natural order, compositæ. Constituents, eupatorin, volatile oil, resin, gum, tannin and sugar.

Preparation: Extractum eupatorii fluidum.

JUGLANS, U. S.—*Butternut.* Inner bark of root of *Juglans cinerea:* natural order, juglandaceæ. Constituents, nucin, tannin, fixed oil, volatile oil.

Preparation: Extractum juglandis.

GLYCRYRHIZA, U. S.—*Licorice Root.* Root of *Glycyrrhiza glabra;* natural order, leguminosæ. Constituents, glycyrrhizin, glycyramarin, sugar, asparagin, resin. Glycyrrhizin is sometimes called glycyrrhizic acid.

Preparations: Extractum glycyrrhizæ fluidum, extractum glycyrrhizæ purum, glycyrrhizinum ammoniatum, pulvis glycyrrhizæ comp., extract sarsaparillæ comp., massa hydrargyri, pilulæ ferri iodidi, syrupus sarsaparillæ comp., tincturæ rhei dulcis.

LEPTANDRA, U. S.—*Culver's Root.* Rhizome and rootlets of *Leptandra Virginica* Nuttall; natural order, scrophulariaceæ. Constituents, leptandrin, resin, saponin, tannin, gum, mannit, etc.

Preparations: Extractum leptandræ, extractum leptandræ fluidum,

QUILLAIA, U. S.—*Soap Bark.* Bark of *Quillaia saponaria;* natural order, rosaceæ. Constituent, saponin.

QUASSIA, U. S. Wood of *Picræna excelsa;* natural order, simarubaceæ. Constituents, quassin, resin.

Preparations: Extract quassiæ, extract quassiæ fluidum, tinctura quassiæ.

RHUBARB, U. S.—*Rheum.* Root of *Rheum officinale* and other as yet undetermined species of rheum; natural order, polygonaceæ. Constituents, chrysophan, chrysophanic acid, erythroretin, emodin, phæoretin, tannin and rheumic acid.

Preparations: Extractum rhei, extractum rhei fluidum, pilulæ rhei, pilulæ rhei compositus, pulvis rhei comp., syrupus rhei, tinctura rhei, tinctura rhei aromatica, tinctura rhei dulcis, vinum rhei.

RHUS TOXICODENDRON, U. S.—*Poison Ivy* or *Poison Oak.* Fresh leaves of *Rhus toxicodendron;* natural order, anacardieæ. Constituents, toxicodendric acid, tannin, etc.

SANTONICA, U. S.—*Levant Worm Seed.* Unexpanded flower heads of *Artemisia maritima;* natural order, compositæ. Constituents, santonin, volatile oil.

SALIX, U. S.—*Willow.* Bark of *Salix alba* and other species of salix; natural order, salicaceæ. Constituents, salicin, tannin.

SARSAPARILLA, U. S. Root of *Smilax officinalis*

and other species of smilax; natural order, smilaceæ. Constituents, parillin, resin, starch and coloring matter.

Preparations: Decoctum sarsaparillæ comp., extractum sarsaparillæ comp., syrupus sarsaparillæ comp., extractum sarsaparillæ fluidum.

SENEGA, U. S. Root of *Polygala senega;* natural order, polygalaceæ. Constituents, senegin, or polygalic acid, fixed oil.

Preparations: abstractum senegæ, extractum senegæ fluidum, syrupus scillæ comp.

SENNA, U. S. Leaflets of *Cassia acutifolia* and *C. elongata;* natural order, leguminosæ. Constituents, cathartic acid, sennacrol, sennit.

Preparations: Confectio sennæ, extractum sennæ fluidum, infusum sennæ comp., pulvis glycyrrhizæ comp., syrupus sarsaparillæ comp., syrupus sennæ.

SQUILL, U. S.—*Scilla.* Bulb of *Urginea scilla;* natural order, liliaceæ. Constituents, scillipiarin, scillitoxin, scillin and mucilage.

Preparations: acetum scillæ, extract scillæ fluidum, syrupus scillæ comp., tincturæ scillæ.

TARAXACUM, U. S.—*Dandelion.* Root of *Taraxicum dens-leonis;* natural order, compositæ. Constituents, inulin, taraxacin, resin, sugar, etc.

Preparations: Extractum taraxaci, extractum taraxci fluidum.

USTILAGO, U. S.—*Corn Smut.* Fungus parasitic on *zea mays:* natural order, graminaceæ. Constituents, fixed oil, crystaline principle and probably sclerotic acid.

UVA URSI, U. S.—*Bearberry.* Leaves of *arctostaphylos uva ursi;* natural order, ericaceæ. Constituents, tannin, arbutin, ericolin and urson.

Preparation: Extractum uva ursi fluidum.

VIBURNUM, U. S—*Black Haw.* Bark of *Viburnum prunifolium;* natural order, caprifoliaceæ. Constituents, bitter principle, bitter resin, valerianic acid and tannin.

Preparation: Extract viburnum fluidum.

VIOLA TRICOLOR. U. S.—*Pansy.* Uncultivated flowering herb of *Viola tricolor;* natural order, violaceæ. Constituents, bitter principle, resin and salicylic acid.

UNOFFICINAL DRUGS—Group 6 (Hallberg).

| COMMON NAME. | BOTANIC NAME. | PART USED. | CONSTITUENTS. |
|---|---|---|---|
| Agaric (white) | Boletus laricis. | White plant. | Laricin, bitter resin, agaric and other acids. |
| Ailanthus. | Ailanthus glandulosa. | Bark. | Ailanthic acid, tannin. |
| Carduus benedictus. | Unicus benedictus. | Herb. | Cnicin, tannin, etc. |
| Chamælirium (false unic'rn) | Chamælirium luteum | R'zome. | Chamælirin. |
| Corn silk. | Zea Mays. | Stigma. | Mayzenic acid, mucilage. |
| Convallaria (lily of the valley) | Convallaria majalis. | R'zome. | Convallarin, convallamarin. |
| Corydalls (Turkey corn) | Dicantra Canadensis. | Tubers. | Corydalin, acrid resin, fumaric acid. |
| Coto. | (Source unknown) | Bark. | Cotoin, volatile oil, piperonylic acid. |
| Epigæa (gravel plant). | Epigœa repens. | Herb. | Arbutin, ericolin, ursone, tannin. |
| Helenium. | Helenium autumnale | R'zome. | Bitter glucoside, resin, tannin |
| Helleborus (black). | Helleborus niger. | Bark. | Hellcborin, helleboreln, resin. |

UNOFFICINAL DRUGS—Group 6—*Continued.*

| COMMON NAME. | BOTANIC NAME. | PART USED. | CONSTITUENTS. |
|---|---|---|---|
| Hippocastanum (horse chestnut) | Aesculua hippocas'm. | Root. | Aesculin. fraxln, tannin. |
| Imperatoria. | Imperatoria Ostruthina. | Leaves. | Imperatorin, volatile oil |
| Kalmia. | Kalmia latifolia. | Herb. | Arbutin, resin, tannin. |
| Lactuca. | Lactuca virosa. | Bark. | Lactucin. lactucic acid, lactucopicrin. |
| Larch. | Larix Americana. | Bark. | Larixinic acid, resin. tannin, volatile oil. |
| Liriodendron | Liriodendron tulipifera. | Bark. | Liriodendrin, resin, tannin. |
| Piscidia. | Piscidia erythrina. | R'zome. | Piscidin, resin. fixed oil. |
| Polygonatum | Polygonatum biflorum and P. giganteum. | Root. | Convallarin, asparagin, etc. |
| Saponaria. | Saponaria officinalis. | Bark. | Saponin. |
| Simaruba. | Simaruba officinalis. | | Quassin, resin, vol. oil. |
| Xanthium. | Xanthium Spinosum and X. Strumarium. | Fruit.. | Xonthostrumarin, resin. |

ALKALOIDAL DRUGS

are those whose virtue depends on the presenee of one or more alkaloids.

Alkaloids, or vegetable alkalies as they are sometimes termed, are peeuliar organie bases eontaining nitrogen, earbon, hydrogen, and, with two exeeptions, oxygen. When heated with alkalies they give off ammonia, and are thus distinguished from the glueosides and neutral prineiples. They form erystallizable salts with aeids, and are, medieinally, the most powerful of all the organie prineiples. They are preeipitated from their saline solutions upon the addition of alkalies. They are generally very poisonous or energetie remedies, having a pungent, bitter or aerid taste. They

are mostly insoluble in water, but soluble in alcohol, chloroform, benzine benzole, and some in ether. Their salts are mostly soluble in water, less so in alcohol, and entirely insoluble in chloroform, ether, benzine and benzole.

The alkaloids may be found in all parts of the plant, but the greater number are contained in the seeds and fruits ; in trees they occur in the bark.

The preparation of alkaloids consists usually in extracting the drug with water acidulated with about 2 per cent. of acid, such acids as hydrochloric or sulphuric being used when the alkaloid is difficultly soluble, while with those more soluble the vegetable acids are employed ; with others, as morphine, the drug is exhausted with water alone, from which it is precipitated by an alkali. It often occurs with some drugs of this character that water extracts a large amount of inert matter, as starch, etc. This renders the extraction of the alkaloids from the extract exceedingly difficult. In such drugs alcohol should be used in extraction ; but this also extracts other inert matter, as resins, fats, etc., which must be rejected before the alkaloid can be obtained pure. This is best accomplished by mixing the extract with water acidulated with an appropriate acid, and exhausting it by repeated washings with the latter. The alkaloidal base is thus formed into a salt and is dissolved in the water which contains acid in excess. The inert matter being nearly insoluble in acidulated water, is left behind. The alkaloid

is then precipitated byan alkali and dissolved in hot alcohol, filtered through animal charcoal and obtained pure by crystallization.

A few alkaloids, owing to their complex form, split up into other substances when subjected to prolonged heat in evaporation or when treated with stronger alkalies. These are obtained from the acidulated aqueous solution, first rendered slightly alkaline, agitating with chloroform, which takes up the alkaloid, and after settling to the bottom of the mixture, is drawn off and leaves the alkaloid pure upon evaporation.

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## Questions on Lecture VIII.

1. To what order does krameria belong?
2. Upon what does the virtue of the refrigerant drugs depend?
3. Upon what does the virtue of the glucosidal drugs depend?
4. What are the officinal preparations of colocynthidis?
5. What is ergot?
6. Name its officinal preparations.
7. Are preparations of ergot more desirable when made with alcohol?
8. If so, why?
9. Upon what do the virtues of alkaloidal drugs depend?
10. Are alkaloids generally poisonous?

## Answers to Questions on Lecture VII.

1. Cotton-seed oil group.
2. Olive oil.
3. Adeps and sevum.
4. Cetraria.
5. For their volatile oil.
6. An anthelmintic.
7. Caryophyllus.
8. Labiatæ.
9. Volatile oil, resin, etc.
10. Leaves and flowering tops.

# PHARMACY.

## Lecture IX.

ALKALOIDS AND SALTS OF THE U. S. P. (Thruston.)

| ALKALOIDS AND SALTS. | SOURCE. | ORDINARY ADULT DOSE |
|---|---|---|
| Apomorphinæ hydrochloras. | Morphine. | gr. $\frac{1}{4}$. |
| Atropina | Belladonna. | gr. 1-100. |
| Atropinæ sulph | Atropine. | gr. 1-100. |
| Caffeine. | Tea, coffee, guarana. | gr. 1-3. |
| Cinchonidinæ | Cinchona. | gr. 1-20. |
| Cinchonia | Cinchona. | gr. 1-20. |
| Cinchoninæ sulph | Cinchona. | gr. 1-20. |
| Codeina | Opium. | $\frac{1}{4}$-1 gr. |
| Hyoscyaminæ sulph | Hyoscyamus | 1-60 to 1-20 grs. |
| Morphina | Opium. | $\frac{1}{4}$ gr. |
| Morphinæ acet. | Morphine | $\frac{1}{4}$ gr. |
| Morphinæ hydrochloras | Directly from Opium. | $\frac{1}{4}$ gr. |
| Morphinæ sulph | | $\frac{1}{4}$ gr. |
| Pilocarpinæ hydrochloras | Pilocarpus. | Hypod. $\frac{1}{6}$ gr. |
| Physostigminæ salicylas | Physostigma. | 1-30 gr. |
| Quinidinæ sulph | Cinchona. | 1 to 3 gr. |

ALKALOIDS AND SALTS—*Continued.*

| ALKALOIDS AND SALTS. | SOURCE. | ORDINARY ADULT DOSE. |
|---|---|---|
| Quinia. ......... ...... | Cinchona. | 1 to 10 gr. |
| Quininæ bisulphas... | Quininæ sulph. | 1 to 10 gr. |
| Quininæ hydrobromas......... ......... | Quininæ sulph. | 1 to 10 gr. |
| Quininæ hydrochloras.. ...... .. . ....... | Quininæ sulph | 1 to 10 gr. |
| Quinniæ sulph....... | Cinchona. | 1 to 10 gr. |
| Quininæ valerianas.. | Quininæ sulph. | 1 to 5 gr. |
| Strychnina............ | Nux Vomica or Ignatia. | 1-60 to 1-20 gr. |
| Strychninæ sulph.... | Strychnina. | 1-60 to 1-20 gr. |
| Veratrina............. | Seed of Asagræa, off. | 1-40 to 1-12 gr. |

CINCHONA.

The cinchona barks are obtained from the different species of the genus cinchona, and vary greatly in the proportion of alkalcid they contain. The Pharmacopœia recognizes the bark obtained from any species of cinchona if it contain not less than 3 per cent. of alkaloid. They are divided into three kinds, according to their color and relative proportion of alkaloids they contain, viz.: yellow cinchona, red cinchona and pale cinchona.

YELLOW CINCHONA, U. S.—*Cinchona Flava.* Bark of trunk of *Cinchona Calisaya*; natural order, rubiaceæ. Contains kinic, kinovic and cinchotannic acids,

quinine, quinidine, cinchonine, cinchonidine and quinamine.

Preparations: Extractum cinchonæ fluidum, infusum cinchonæ, tinctura cinchonæ.

RED CINCHONA, U. S.—*Cinchona Rubra.* Bark of trunk of *Cinchona succirubra;* natural order, rubiaceæ. Contains (same as cinchona flava).

Preparation: Tinctura cinchona comp.

PALE CINCHONA, U. S.—*Cinchona Pallida.* Pale bark of *Cinchona officinalis;* natural order, rubiaceæ. Contains in less proportion the same constituents as other species of cinchona.

OPIUM, U. S. Concrete milky exudation obtained by incising the unripe capsules of *Papaver somniferum;* natural order papaveraceæ. Contains morphine, codeine, thebaine, narcotine, narceine, pseudo morphine, papaverine, cryptopine, protopine, laudanine. codamine, and other alkaloids; also meconic acid and meconin.

Preparations: Extractum opii, opium denarcotisatum, tinctura opii comp., tinctura opii, acetum opii, vinum opii, tinctura opii deod., tinctura ipecac. et opii, pilulæ opii, opii pulvis, emplastrum opii, pulvis ipecacuanhæ et opii, trochisci glycyrrhizæ et opii. Denarcotized opium is a preparation of opium prepared from opium, and not the crude drug. It should contain at least 12 per cent. morphine, and not more than 16 per cent. For adulterations, etc., see U. S. Disp.

NUX VOMICA, U. S.—*Nux Vomica.* Seed of *Strych-*

*nos nux vomica;* natural order, loganiaceæ. Contains strychnine, brucine, loganine, igasuric acid.

Preparations: Abstractum nucis vomicæ, extractum nucis vomicæ, extractum nucis vomicæ fluidum, tinctura nucis vomicæ.

ACONITI RADIX, U. S.—*Aconitum.*—The tuberous root of *Aconitum Napellus;* natural order, ranunculaceæ. Contains aconitine, napelline, pseudoaconitine, aconitic acid, etc.

Preparations: Abstractum aconiti, extractum aconiti, extractum aconiti fluidum, tinctura aconiti.

BELLADONNA RADIX, U. S.—Root of *Atropa belladonna;* natural order, solanaceæ. Contains atropine, belladonnine, hyoscymine, etc.

Preparations: Abstractum belladonnæ, emplastrum belladonnæ, extractum belladonnæ fluidum.

BELLADONNA LEAVES, U. S.—*Belladonnæ folia;* natural order, solanaceæ. Contains atropine, belladonnine, hyoscyamine, mucilage, etc.

Preparations: Extractum belladonnæ alcoholicum, tinctura belladonnæ.

CHELIDONIUM, U. S.—*Celandine.* Herb of *Chelidonium majus;* natural order, papaveraceæ. Contains chelidonine, chelidoxanthin, chelidonic acid.

COLCHICUM RADIX, U. S.—*Colchici Radix.* Tuber of *Colchicum autumnale;* natural order, melanthaceæ. Contains colchicine, starch, gum, fat, sugar, resin, etc.

Preparations: Extractum colchici aceticum, extractum colchici radicis fluidum, vinum colchici radicis.

COLCHICUM SEED, U. S.—*Colchici semen.* Seed of *Colchicum autumnale;* natural order, melanthaceæ. Contains colchicine, colchiceine, fixed oil.

Preparations: Extractum colchici seminis fluidum, tinctura colchici seminis, vinum colchici seminis.

CONIUM, U. S.—*Poison Hemlock.* Fruit of *Conii maculatum;* natural order, umbelliferæ. Contains coniine, conhydrine, fixed oil, volatile oil.

Preparations: Abstractum conii, extractum conii alcoholicum, extractum conii fluidum, tinctura conii.

Coniine is a volatile liquid alkaloid, and care should be used in making preparations of conium not to subject them to a high temperature.

ERYTHROXYLON, U. S.—*Coca.* Leaves of *Erythroxylon coca;* natural order, erythroxylaceæ. Contains cocaine, hygrine.

Preparation: Extractum erythroxyli fluidum.

GELSEMIUM, U. S.—*Gelsemium.* Rhizome and rootlets of *Gelsemium sempervirens;* natural order, loganiaceæ. Contains volatile oil, gelsemine, gelseminic acid and resin.

Preparations: Fluid extract gelsemii, tinctura gelsemii.

GUARANA, U. S.—*Guarana.* Dried paste prepared from crushed seed of *Paullinia sorbilis;* natural order, sapindaceæ. Contains caffeine, tannin, saponin and resin.

Preparation: Extractum guaranæ fluidum.

HYDRASTIS, U. S.—*Golden Seal.* Rhizome and

rootlets of *Hydrastis Canadensis;* natural order, ranunculaceæ. Contains berberine, hydrastine, xanthopuccine, sugar, starch, resin.

Preparations: Extractum hydrastis fluidum, tinctura hydrastis.

HUMULUS, U. S.—*Hops.* Strobiles of *Humulus lupulus;* natural order, urticaceæ. Contains volatile oil, tannin, resin, lupulin.

Preparation: Tinctura humuli.

HYOSCYAMUS, U. S. — *Henbane.* Leaves of *Hyoscyamus niger;* natural order, solanaceæ. Contains hyoscyamine, hyoscine and hyoscypicrin.

Preparations: Abstractum hyoscyami, extractum hyoscyami alcoholicum extractum hyoscyami fluidum, tinctura hyoscyami.

IGNATIA, U. S.—*Ignatia.* Bean seed of *strychnos ignatia;* natural order, loganiaceæ. Contains strychnine, brucine.

Preparations: Abstractum ignatiæ, tinctura ignatiæ.

IPECACUANHAH, U. S.—*Ipecac.* Root of *Cephaelis ipecacuanhah;* natural order, rubiaceæ. Contains emetine, ipecacuanhic acid, resin, pectin, starch, sugar, etc.

Preparations: Extractum ipecacuanhæ fluidum, pulvis ipecacuanhæ et opii, trochisci ipecacuanhæ, trochisci morphinæ et ipecacuanhæ.

LOBELIA, U. S.—*Lobelia.* Leaves and tops of *Lobelia inflata;* natural order, lobeliaceæ. Contains lobeline, lobelacrin, lobelic acid and resin.

Preparations: Acetum lobeliæ, extractum lobeliæ fluidum, tinctura lobeliæ.

MENISPERMUM, U. S.—*Moonseed.* Rhizome and rootlets of *Menispermum Canadense;* natural order, menispermaceæ. Contains berberine, menispine and resin.

PAREIRA, U. S.—*Pareira Brava.* Root of *Chondodendron tomentosum;* natural order, menispermaceæ. Contains pelosine, resin.

Preparation: Extractum pareiræ fluidum.

PHYSOSTIGMA, U. S.—*Calabar Bean.* Seed of *Physostigma venenosum;* natural order, leguminosæ. Contains physostigmine, calabarine and physosterin.

Preparations: Extractum physostigmatis, tinctura physostigmatis.

PILOCARPUS, U. S.—*Jaborandi.* Leaflets of *Pilocarpus pennatifolius;* natural order, rutaceæ. Contains pilocarpine, volatile oil.

Preparation: Extractum pilocarpi fluidum.

POMGRANATE, U. S.—*Granatum.* Root and bark of *Punica granatum;* natural order, granataceæ. Contains pelleticrine, punicine, tannin, mannit, pectin, etc.

SANGUINARIA, U. S.—*Blood Root.* Rhizome of *Sanguinaria Canadensis;* natural order, papaveraceæ. Contains sanguinarine, resin.

Preparations: Acetum sanguinariæ, extractum sanguinariæ fluidum, tinctura sanguinariæ.

SCOPARIUS, U. S.—*Broom.* Tops of *Sarothamnus*

*scoparius;* natural order, leguminosæ. Contains scoparin, sparteine, tannin, volatile oil.

SPIGELIA, U. S.—*Pink Root.* Rhizome and rootlets of *Spigelia marilandica;* natural order, loganiaceæ. Contains volatile oil, bitter alkaloidal principle and resin.

Preparation: Extractum spigelia fluidum.

STAPHISAGRIA, U. S.—*Stavesacre.* Seed of *Delphinum staphisagria;* natural order, ranuncalaceæ. Contains delphinine, delphinoidine, delphisine and fixed oil.

STRAMONIUM LEAVES, U. S.—*Stramonii Folia.* Leaves of *Datura stramonium;* natural order, solanaceæ. Contains atropine and hyoscyamine. This mix ture was formerly called daturine.

STRAMONIUM SEEDS, U. S.—*Stramonii Semen.* Seed of *Datura stramonium;* natural order, solanaceæ. Contains atropine, hyoscyamine, fixed oil.

Preparations: Extractum stramonii, extractum stramonii fluidum, tinctura stramonii.

TOBACCO, U. S.—*Tabacum.* Dried leaves of *Nicotiana tabacum;* natural order, solanaceæ. Contains nicotine, nicotianin, resin, extractive matter.

VERATRUM VIRIDE, U. S. — *Veratrum Viride* (American hellebore). Rhizome and rootlets of *Veratrum viride;* natural order, melanthaceæ. Contains jervine, pseudo-jervine, rubijervine, veratroidine and resin.

Preparations: Extractum veratri viridis fluidum, tinctura veratri viridis.

Artificial alkaloids are produced from natural alkaloids by decomposition with alkalies, from coal tar derivatives, including the anilines, and from cinchona alkaloids. Animal alkaloids are found in different parts of animal bodies, and often possess poisonous properties.

UNOFFICINAL DRUGS—Group 7 (Hallberg).

| COMMON NAME. | BOTANIC NAME. | PART USED. | CONSTITUENTS. |
|---|---|---|---|
| Achillea | Achillæa millefolium. | Herb. | Achilleine, resin, vol. oil, tannin. |
| Alstonla | Alstonia constricta. | Bark. | Ditaine, ditamine, resin. |
| Angustura | Galipea cusparia. | Bark. | Angusturine, resins, volatile oil. |
| Ash (white) | Fraxinus Americana. | Bark. | Alkaloid, volatile oil. |
| Baptisia | Baptisia tinctoria. | Root. | Baptisine, resin, etc |
| Barberry | Berberis vulgaris. Berberis avuifolium | Root or root bark, rhizome. | Berberine, vineline, etc. |
| Boldus | Boldus fragrans. | Leaves. | Boldine, resin, volatile oil. |
| Cevadilla | Veratrum sabadilla. | Seeds. | Veratrine, cevadine, cevadillin. |
| Cicuta | Cicuta maculata. | Herb. | Cicutine. |
| Coffee | Caffæa Arabica. | Seeds. | Caffeine, vol. oil. tannin. |
| Cuprea bark | Remijia pedanculata. Remija purdieana. | Seeds. | Quinine and other cinchona alkaloids |
| Delphinium | Delphinium consolida. | Seeds. | Delphinine, fixed oil, etc. |
| Gold thread | Coptis trifoliata. | Herb. | Berberine. coptine, resin. |
| Jequiriti | Abrus precatorius. | Seeds. | Alkaloid. abric acid, fixed oil. |
| Mate | Ilex Paraguensis. | Leaves. | Caffeine, tannin, vol. oil. |

UNOFFICINAL DRUGS—Group 7—*Continued.*

| COMMON NAME | BOTANIC NAME. | PART USED. | CONSTITUENTS. |
|---|---|---|---|
| Nectandra ... | Nectandra Rodiæi. | Bark. | Berberine, sipirine, etc. |
| Poppy......... | Papaver somniferum. | Fruit. | Opium alkaloids (see opium). |
| Ptelea......... | Ptelia trifoliata. | Root bark | Berberine, vol. oil, etc |
| Quebracho ... | Quebracho blanco. | Bark. | Aspidospermine, quebrachine, tannin. |
| Sarracenia... | Sarraccnia purpurea. | Herb and root. | Sarracenine, acrylic & sarracenic acids. |
| Theobroma.- | Theobroma cacao. | Seeds. | Caffeine, theobromine, fixed oils |
| Veratrum (white) (Hellebore). | Veratrum album. | Rhizome. | Jervine, pseudojervine, rubijervine, veratralbine, etc. |
| Xanthorrhiza. | Xanthorriza aplifolia. | Root. | Berberine. |

UNCLASSIFIED DRUGS.

This group includes those miscellaneous vegetable drugs whose constituents are not known, and those whose constituents cannot be properly classified under any other group. This group also includes drugs of animal origin.

CANTHARIDES, U. S.—*Cantharis.* Whole animal of *Cantharis vesicatoria;* natural order, coleoptera, of the insecta class. Contains cantharidin.

Preparations: Ceratum cantharidis, ceratum extracti cantharidis, charta cantharidis, collodium cum cantharide, linimentum cantharidis, tinctura cantharidis.

CHARCOAL, U. S.—*Carbo Ligni.* Made from soft

wood by burning it with a limited supply of air. Contains carbon and earthy matters.

ANIMAL CHARCOAL, U. S.—*Carbo Animalis.* Made from the bone of vertebrate animals by burning with a limited supply of air. Contains carbon, phosphate lime, carbonate of lime, etc.

COCHINEAL, U. S.—*Coccus.* Dried female of *Coccus cacti;* natural order, hemiptera, of the class insecta. Contains carminic acid.

Preparation: Tinctura cardamomi comp.

OX GALL, U. S.—*Fel Bovis.* Fresh gall of *Bos Taurus;* natural order, ruminantia of the mammalia class. Contains bilirubin, cholesterin, glycocholic and taurocholic acids.

Preparations: Fel bovis inspissatum, fel bovis purificatum.

ISINGLASS, U. S.—*Ichthyocolla.* The swimming bladder of *Acipenser Huso* and other species of the same genus; natural order, sturiones, of the pisces class. Contains gelatin.

Preparation: Emplastrum ichthyocollæ.

MUSK, U. S.—*Moschus.* Dried secretion from preputial follicles of male of *Moschus moschiferus;* natural order, ruminantia, of the mammalia class. Contains cholesterin, fat, ammonia, albuminous and gelatinous substances, etc.

Preparation: Tinctura moschi.

PEPSIN (sacch.), U. S.—*Pepsinum Saccharatum*—pepsin 50 per cent. The digestive principle of the gas-

tric juice, from the mucous membrane of the stomach of the hog, mixed with sugar of milk.

Preparation: Liquor pepsini.

The U. S. P. directs that it should be of such strength that one grain, dissolved in 500 grains of water, acidulated with 7.5 grains hydrochloric acid, mixed with 50 grains hard-boiled egg albumen in shavings, should form a mixture which, on being kept at 100° to 104° F., becomes a slightly opalescent solution in five or six hours.

PANCREATIN. A peculiar ferment from the pancreatic juice secreted by the pancreas, a gland situated near the lower abdomen in carniverous animals. Contains several complex albuminous substances.

YOLK OF EGG, U. S.—*Vitellus.* Yolk of egg of *Gallus bankiva;* natural order, gallinæ of the aves class. Contains vitellin, fixed oil, inorganic salts, etc.

Preparation: Glyceritum vitelli.

UNOFFICINAL DRUGS—Group 8 (Hallberg).

| COMMON NAME. | SCIENTIFIC NAME. | PART USED. | CONSTITUENTS. |
|---|---|---|---|
| | *Vegetable Drugs.* | | |
| Cactus.......... | Cactus grandiflorus. | Herb. | Acrid juice (no analysis). |
| Clover tops.. | Trifolium pratense. | Flow'ring tops. | No analysis. |
| Fucus. ......... | Fucus vesciculosus & other species of fucus. | Whole plant. | Salts of iodine, bromine, etc. |
| Galium. ...... | Galium Aparine. | Herb. | Cumarine, tannin. etc. |

UNOFFICINAL DRUGS—Group 8—*Continued.*

| COMMON NAME. | SCIENTIFIC NAME. | PART USED | CONSTITUENTS. |
|---|---|---|---|
| Hydrangea... | Hydrangea aborescens. | Root. | (No analysis.) |
| Mitchella ..... | Mitchella repens. | Herb. | (No analysis). |
| | *Animal Drugs.* | | |
| Ambergris ... | Ambra Grisea. | | Ambriin, etc. |
| Blatta.. ........ | Blatta Orientalis. | Insect. | Antihydropin, fats, etc. |
| Castoreum .. | Castor Fiber. | Glandul'r secretion. | Vol. oil, castorin, salicine, etc. |
| Civet............ | Viverra Zibetha or Viverra Civetta. | Glandul'r secretion. | Vol oil, fat, resinous ma ter, salts, etc. |
| Bone ............ | Os. | | Calcium phosphat's, calcium carbonates, magnesium phosphates, animal matter, etc. |
| Coral............ | Corallium rubrum & Oculina Virginea. | Calcareous skeleton. | Calcium carbonate, magnesium carbonate, animal matter. |
| Cuttle-bone.. | Os Sepiæ. | Calcareous skeleton. | Calcium carbonate, magnesium carbonate, animal matter, traces of phosphates. |
| Gelatin ........ | Gelatina. | | (Glue consists of gelatin, chondrin and various impurities |
| Hyraceum ... | Hyrax Capensis. | Excretion or secretion. | Vol. oil, resin, fat, various acids and salts. |
| Milk...... ...... | Lac vaccinum. | | Casein, lactoprotein, fixed oil, milk sugar, various salts |
| Pancreatin... | Pancreatinum. | | Several complex ferments. |
| Ptyalin.. ...... | Ptyalin. | | Similar to diastase. |
| Sponge. ....... | Spongia officinalis. | Horny skeleton or ash. | Spongin, various salts, including iodides |

## THE INORGANIC ACIDS.

"Acids, whether organic or inorganic, except in case of the so called haloid acids, like hydrochloric, are built on the water molecule type, and consist of a molecule, or a group of atoms united by oxygen and hydrogen."

Acids are distinguished from other bodies by three properties: First, they all contain hydrogen, and are sometimes called hydrogen salts. The hydrogen is capable of being replaced by metals. Second, those which are soluble have a sour taste and corrosive action. Third, they act on litmus and other vegetable substances, changing their color.

The inorganic acids may be divided into three classes, viz.: those containing no oxygen and obtained from non-metallic elements, and the anhydrides from metallic elements.

Some acids are solid, some liquid, and some gaseous at ordinary temperatures. We will enter into a description only of such acids as are of importance in pharmacy. A molecule of water may be represented thus: $H_2O$. This means that in a molecule of water there are two atoms of hydrogen and one atom of oxygen.

Acids, bases and salts are said to be formed on the water type, thus:

H H O=a molecule of water.

H, a negative element, and oxygen=a molecule of an acid.

A positive element, hydrogen and oxygen=a molecule of a base.

A positive element, a negative element and oxygen=a moleeule of a salt.

In the above water type, by a negative element is meant one negative to hydrogen, and by a positive element, one positive to hydrogen.

The moleeular plan of haloid acids differs from those of other aeids by having the negative radical directly united to hydrogen without the eonnecting oxygen atom, as HCl. These acids form a series of salts by uniting with bases, as NaCl, H being displaeed by the base.

ARSENIOUS ACID, U. S.—*Acidum Arseniosum.* In the strict sense this is arsenious anhydride, and is not an acid; however, if it be dissolved in water arsenious aeid is formed, and henee, in the presence of moisture, arsenious anhydride always exhibits an acid reaction. It is obtained by heating arsenieal pyrites in earthen cylinders. When the arsenie vaporizes and is eollected in receivers, to render it more pure it is resublimed.

It is a powerful irritating poison, the best antidote for which is freshly precipitated ferrie hydrate.

Preparations: Liquor acidi arseniosi and liquor patassii arsenitis.

HYDROFLUORIC ACID.—*Acidum Hydrofluoricum.* Obtained by distilling powdered flourspar with sulphurie aeid in a leaden retort and condensing the vapor

in water. Care must be observed in the process not to breathe the vapor.

Hydrofluoric acid is not officinal. The pure acid is a colorless, fuming liquid, highly volatile. It is soluble in water. The aqueous solution is generally termed hydrofluoric acid. It is extremely caustic and must be preserved in bottles made of gutta percha or lead.

Boric Acid, U. S. P.—*Acidum Boricum.* It occurs in the form of transparent, colorless, six-sided plates, somewhat unctuous to the touch, permanent in the air; cooling, bitterish taste; feebly acid in solution. It is obtained in the lagoons in Tuscany, in California lakes, etc., in the form of boric acid and borate sodium.

Boric acid is made by decomposing borax with hydrochloric acid.

Preparation: Boro-glyceride, prepared by heating 62 parts of boric acid with 93 parts glycerine to 300° F., until aqueous vapors cease to rise.

Carbonic Acid.—*Acidum Carbonicum.* A colorless gas, not stable at ordinary temperature, decomposing into water and carbon dioxide. It is found combined with Ca in a large class of salts, known as the carbonates, viz.; limestone, marble, chalk, etc., forming nearly one-half their weight. Carbonic acid is a feeble acid, being readily displaced from its combinations by the mineral and many of the organic acids.

Chromic Acid, U. S. P.—*Acidum Chromicum.* Delicate crimson, needle-like crystals, or lustrous scarlet, rhombic prisms, very deliquescent in moist air,

and intensely caustic when brought in contact with animal tissues. It is soluble in water, forming an orange-red solution. Chromic anhydride is obtained by adding to one volume of cold, saturated solution of potassium bichromate one and one-half volume of concentrated sulphuric acid. The anhydride crystallizes out on cooling in the form of delicate red needles; this added to water forms true chromic acid. By mixing with glycerine, alcohol or other readily oxidizable substance, rapid combustion or explosion takes place.

HYDROBROMIC ACID.—*Acidum Hydrobromicum* (a haloid acid). A colorless gas, with a strong irritating odor and acrid taste and reaction. It liquifies at a temperature of 73° C., and becomes a colorless solid at 87° C. It fumes on exposure to the air. It has a strong affinity for water, and is readily soluble in that liquid. It is made by the action of water on bromide of phosphorus. The hydrobromic acid is separated from the phosphoric acid by distillation.

Preparation; Acidum hydrobromicum dil.

ACIDUM HYDROBROMICUM DILUTUM, U. S.—*Diluted Hydrobromic Acid.* A clear, colorless liquid, composed of 10 per cent. absolute HBr. and 90 per cent. water; odorless, strong acid taste and reaction; prepared by distillation and double decomposition and precipitation.

HYDROCHLORIC ACID, U. S. P.—*Acidum Hydrochloricum* (a haloid acid). A colorless, fuming liquid, compound of 31.9 per cent. absolute HCl, and 68.1 per cent.

water. It has a pungent, suffocating odor; intensely acid taste; strong acid reaction. Absolute hydrochloric acid is gaseous at ordinary temperature.

Hydrochloric acid is obtained pure by treating pure sodium chloride with pure sulphuric acid and collecting the gas over mercury. The aqueons acid is obtained by passing the gas through water, the latter absorbing it in large quantities.

Preparation: Diluted hydrochloric acid, composed of HCl, U. S. P., 6 parts; add water, 13 parts, and contains 10 per cent. of absolute hydrochloric acid.

HYDROCYANIC ACID.—*Acidum Hydrocyanicum.* A colorless, mobile and volatile liquid, with an odor resembling bitter almonds. It is soluble in alcohol, water and ether in all proportions. The liquid is readily inflammable. The pure acid is a most deadly poison, .05of a grain having, when taken internally, produced death. Its soluble salts are also highly poisonous; therefore all preparations of which it forms a part must be handled with caution. It occurs naturally in some vegetable structures, viz.: bitter almonds, cherry, laurel, etc., but for pharmaceutical purposes is obtained by distilling prussiate of potassium with sulphuric acid and water.

Preparations: Acidum hydrocyanic dilutum, U. S. P., which contains 2 per cent. of the absolute acid dissolved in 98 per cent. of a mixture of alcohol and water. As the acid is highly volatile, it must be kept in tightly stopped bottles, in a cool, dark place.

NITRIC ACID, U. S. P.—*Acidum Nitricum.* A colorless, fuming, caustic and corrosive liquid, composed of 69.4 per cent. absolute $HNO_3$ and 30.6 per cent water. It has a peculiar suffocating odor and strong acid reaction. It must be kept in tight-fitting stoppered bottles, as it rapidly absorbs moisture from the air. It is obtained by distilling nitrate sodium or potassium with sulphuric acid.

Preparations: Acidum nitricum dilutum, contains 1 part officinal acid and 6 parts water, corresponding to 10 per cent. of absolute nitric acid; acidum nitrohydrochloricum (U. S. P.), sometimes called aqua regia, on account of its power to dissolve gold, is a mixture of 4 parts of nitric acid and 15 parts of hydrochloric acid; acidum nitrohydrochloricum dilutum (U. S. P.) contains 19 parts nitrohydrochloric acid and 76 parts of water.

ACIDUM PHOSPHORICUM, U. S.—*Phosphoric Acid.* A colorless, syrupy liquid, composed of 50 per cent. orthophosphoric acid and 50 per cent of water. Special directions for its preparation are given in the U. S. P.

Preparation: Acidum phosphoricum dilutum (U. S. P.) contains 20 parts officinal phosphoric acid and 80 parts aqua destillata. It contains 10 per cent. of the absolute acid.

SULPHURIC ACID, U. S.—*Acidum Sulphuricum.* This is the most important and useful of all acids. By means of it the greater majority of the other acids are prepared. It is a colorless liquid, of an oily appear-

ance, composed of not less than 96 per cent. absolute $H_2SO_4$, and not more than 4 per cent. water; inodorous, strongly caustic and corrosive, with a strong acid reaction. It may be obtained by the decomposition of certain sulphates, as iron, by means of heat, but is generally prepared by bringing together in a leaden chamber the fumes of burning sulphur, steam and nitrous fumes.

Preparations: Acidum sulphuricum aromaticum (U. S. P.) contains 200 parts sulphuric acid (U. S. P.), tinctura ginger (U. S. P.), 45 parts. oil cinnamon, 1 part, alcohol sufficient to make 1,000 parts. The directions given in the U. S. P. should be carefully followed that no accident may occur. Acidum sulphuricum dilutum (U. S. P.), a colorless liquid, consists of 1 part sulphuric acid (U. S. P.), and 9 parts distilled water, and contains at least 9.6 per cent. of absolute acid and 10 per cent. of officinal acid.

Fuming sulphuric acid, Nordhausen acid, a thick, oily, fuming liquid, obtained by distilling basic ferric sulphate in earthen retorts, and consists of a mixture of ordinary sulphuric acid with sulphuric anhydride.

Sulphuric anhydride is obtained by distilling Nordhausen acid; also by passing sulphurous anhydride, mixed with oxygen, over platinum sponge or pulverized asbestos heated to redness. It exists as transparent prisms.

Sulphurous Acid, U. S.—*Acidum Sulphurosum.* A colorless liquid, possessing a characteristic sulphurous odor and taste; consists of 3.5 per cent. of sulphur-

ous acid gas and about 96.5 per cent. of water. It is obtained by heating charcoal and sulphuric acid together and passing the gas through a wash bottle containing distilled water, in which it is dissolved.

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## Questions on Lecture IX.

1. The cinchona barks are obtained from what?
2. From what is atropine obtained?
3. Artificial alkaloids are produced from what?
4. How?
5. How is charcoal prepared?
6. What is isinglass?
7. What acids are built on the water type molecule?
8. By what other name are acids sometimes called?
9. Hydrogen, a negative element, and oily gum forms what?
10. What is HHO?

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## Answers to Questions on Lecture VIII.

1. Polygalaceæ.
2. The presence of citric, malic and tartaric acids.
3. The presence of glucosides and neutral principles.
4. Extract colycynth, extract colycynthidis comp.
5. The sclerotinin of claviceps purpurea.

6. Fluid extract ergot, extract ergot, vinum ergot.
7. No.
8. No; aqueous preparations are more desirable because the medicinal principle desired is more soluble in water.
9. The presence of alkaloids.
10. Yes.

# PHARMACY.

## Lecture X.

### THE NITROGEN COMPOUNDS.

Only those most important in pharmacy will be described. The most important of the nitrogen compounds is ammonia. Ammonia is a colorless gas, and may be obtained by heating any of its salts with an alkali or an alkaline earth, such as lime. It is usually obtained by heating sal ammoniac with an excess of lime. It possesses a pungent odor and a strong alkaline reaction; it neutralizes the acids, and forms stable compounds with them. All ammonia salts are completely volatalized by heat. It is very soluble in water, and, entering into combination with it, forms ammonium hydrate.

Aqua Ammoniæ, U. S.—Water of Ammonia. A colorless, trænsparent liquid, with a very pungent odor; acrid, alkaline taste; strong alkaline reaction; consisting of an aqueous solution of ammonia, containing 10 per cent. by weight of the gas. Prepared by mixing

ammonium chloride with milk of lime and distilling over the gas into distilled water.

Preparation: Linimentum ammoniæ, spiritus ammoniæ aromaticus.

The strength of aqua ammoniæ of commerce is usually designated by one or more Fs. The number of Fs does not indicate the percentage strength of the ammonia water, although the mark 4F is supposed to mean stronger water of ammonia, or 28 per cent.

STRONGER WATER OF AMMONIA, U. S. P.—*Aqua Ammoniæ Fortior.* Contains 28 per cent. by weight of ammonia gas. It should be kept in a cool place, in tightly stopped bottles which should not be quite filled.

Preparation: Spiritus ammoniæ.

SPIRITUS AMMONIÆ, U. S.—Spirit of ammonia. An alcoholic solution of ammonia, containing 10 per cent. by weight of the gas.

SPIRITUS AMMONIÆ AROMATICUS, U. S.—Aromatic Spirit of Ammonia. An aromatic hydro-alcoholic solution of ammonium carbonate, and contains 4 parts ammonium carbonate, 10 parts aqua ammoniæ, ½ part oil lemon, 0.1 part oil of lavender flc., 0.1 part of pimento, 70 parts alcohol, 15 parts water.

LIQUOR AMMONII ACETATIS, U, S.—Solution of Acetate of Ammonia. A clear, colorless liquid, mildly saline taste, or slightly acid reaction. Prepared by mixing solution of acetic acid and ammonium carbonate. This preparation should always be prepared extemporaneously, as it rapidly loses its carbonic acid.

Preparation: Mistura ferri et ammonii acetatis.

AMMONII BENZOAS, U. S.—Benzoate of Ammonium. Thin, white, four-sided, laminar crystals, permanent in the air, with a slight odor of benzoic acid; saline, afterwards slightly acrid taste; neutral reaction. Prepared by saturating benzoic acid with ammonia and evaporating, keeping the ammonia in excess until crystals begin to form.

AMMONII BROMIDUM, U. S.—Bromide of Ammonium. Colorless, transparent, prismatic crystals, or a white granular salt, which becomes yellow on exposure to air; odorless; pungent saline taste; neutral reaction. Prepared by adding water of ammonia gradually to bromine under water (Piles' process).

AMMONIUM CARBONATE, U. S. P.—*Ammonii Carbonas.* White, translucent masses, consisting of bicarbonate of ammonium and ammonium carbamate, losing both ammonia and carbonic acid gas on exposure to air, becoming opaque, and finally converted into friable porous lumps or white powder; pungent, ammoniacal odor; sharp saline taste; alkaline reaction. It must be kept in tightly closed jars to protect it from the air. Prepared by subliming a mixture of ammonium chloride and calcium carbonate.

AMMONII CALORIDUM, U. S.—Chloride of Ammonium. A snow-white crystalline powder, permanent in the air; odorless; cooling, saline taste; slight acid reaction, and when heated with caustic potash or lime liberates ammonia gas. It is usually prepared from

the ammoniacal liquors of the gas works by heating it with lime and conducting the ammonia gas which is liberated into diluted hydrochloric acid until it is saturated. After evaporation and crystallization, the product is purified by sublimation. The crude unsublimated is commonly called "sal ammoniac."

Preparation: Trochisci ammonii chloridi.

AMMONII CHLORIDUM PURIFACTUM is obtained by dissolving crude sal ammoniac in twice its weight of hot water, adding a little chlorine water to convert any ferrous chloride present into a ferric salt; then ammonia in excess, which precipitates the iron present in the form of ferric hydrate. The liquid is then filtered, and the clear filtrate evaporated until a pellicle forms, when it is allowed to cool and crystallize; or it may be evaporated nearly to dryness in a shallow vessel, aud the granular, crystalline powder dried be tween sheets of filter paper.

AMMONIUM IODIDE, U. S. P.—*Ammonii Iodidi.* A white granular, deliquescent salt, or minute crystalline cubes, and changing to yellow or yellowish brown on exposure to the air; odorless when white, but emits a slight odor of iodine when colored; possesses a sharp saline taste; neutral reaction. Prepared by saturating ammonia with hydriodic acid.

AMMONIUM CITRATE. Made by saturating a solution of citric acid with water of ammonia so as to be of a faint alkaline reaction, which is recognized by a slight odor of ammonia.

AMMONIUM NITRATE, U. S.—*Ammonii Nitras.* Colorless crystals, generally in the form of long, thin rhombic prisms or fused masses; somewhat deliquescent: odorless; sharp, bitter taste; neutral reaction; dissolves at ordinary temperature in half its weight of water and in twenty parts of alcohol, and is much more freely soluble in both at their boiling points. Prepared by treating dilute nitric acid with ammonia.

AMMONIUM OXALATE. Made by saturating a solution of oxalic acid with ammonia and crystallizing.

AMMONIUM PHOSPHATE, U. S. P.—*Ammonii Phosphas.* Colorless, translucent, monoclinic prisms, liberatingammonia on exposure to dry air; odorless; cooling, saline taste; neutral or faintly alkaline reaction. Prepared by mixing solution of phosphoric acid and ammonia water and evaporating slowly until crystals form.

AMMONIUM SULPHATE, U. S. P.—*Ammonii Sulphas.* Colorless, transparent, rhombic prisms, permanent in the air; odorless; sharp saline taste, and neutral reaction. Prepared by heating ammoniacal gas liquor with lime and conducting the ammonia gas evolved into dilute sulphuric acid, evaporating and crystallizing.

AMMONIUM VALERIANATE, U. S, P.—*Ammonii Valerianas.* Colorless or white quadrangular plates; deliquescent in moist air; possessing the peculiar odor of valerianic acid; sharp, sweetish taste; neutral reaction. Prepared by passing dry ammonia gas into valerianic acid, when the salt crystallizes out.

## BORON.

Boron occurs in nature combined with oxygen and hydrogen to form boric acid; also in the form of certain salts of this acid, the most important being borax. Boron exists in three allotropic forms—crystalline, amorphous and graphitoidal (same as carbon). The only compound of boron of importance in pharmacy, except boracic acid, is

Borax, U. S.—*Sodii Boras.* Crystalline, transparent, shining, colorless, somewhat efflorescent crystals, possessing a mild, cooling, somewhat alkaline taste and reaction; soluble in 16 parts of water at 15° C.; insoluble in alcohol; when heated it parts with its water of crystallization, first forming a porous mass and then fusing into transparent glass.

Bromine. A dark, brownish-red, mobile liquid, evolving at ordinary temperature a yellowish-red vapor, highly irritating to the eyes and lungs; solidifying at 22° C.; peculiarly suffocating odor, somewhat resembling chlorine. It is not found in nature, but its compounds are not uncommon, occurring in combination with sodium, potassium, silver, calcium, etc. It also occurs in sea water and in the water of many saline springs. It is usually obtained by concentrating the mother liquors containing its salts and treating them with chlorine, which displaces the bromine from its compounds. Bromine must be preserved in small, tightly-fitting glass-stoppered bottles; it is very vola-

tile, and escapes even when every precaution has been taken to prevent.

CARBON is a constituent of all organic substances, and is found in nature in such modifications as charcoal, plumbago, diamond, etc.; the two latter are of but slight importance in pharmacy, but charcoal plays an important part, as it possesses the property of condensing large quantities of oxygen and other gases on the surface of its particles.

ANIMAL CHARCOAL, U. S. P.—*Carbo Animalis.* A solid in the form of dull, black powder, odorless and nearly tasteless. Prepared by subjecting bones to a red heat in closed vessels.

PURIFIED ANIMAL CHARCOAL, U. S. P.—*Carbo Animalis Purificatus.* Animal charcoal purified from calcium salts by hydrochloric acid, leaving the nearly pure carbon residue.

WOOD CHARCOAL, U. S. P.—*Carbo Ligni.* Prepared by burning wood in a limited supply of air until all the volatile properties have been driven off or consumed.

### COMPOUNDS OF CARBON.

These are numerous and very important. All organic and many of the so-called mineral compounds coming under this head, the carbonates of importance will be treated under the respective metals. We will here mention only—

BISULPHIDE OF CARBON, U. S. P.—*Carbonei Bisulphidum.* A clear, colorless, strongly refractive, vola-

tile and inflammable liquid, possessing a strong, disagreeable odor, and a sharp, aromatic taste. It is completely insoluble in water.

## CHLORINE.

A greenish-yellow, gaseous body, having a very suffocating odor; under a pressure of 6 atmospheres at 0° C., convertible into a yellow liquid; it dissolves in about half its volume of cold water; it unites with great energy with hydrogen to form hydrochloric acid, and owing to this affinity is a powerful bleaching agent.

Preparation: Aqua chlori.

Aqua Chlori, U. S. P.—Chlorine Water. A greenish-yellow, clear liquid, having a suffocating odor and disagreeable taste of chlorine. It should contain not less than 4 per cent. of the gas. Prepared by passing chlorine gas, generated by heating hydrochloric acid with manganese dioxide into distilled water, until a saturated solution is produced. It should be kept secluded from the light.

Calx Chlorinata, U. S. P.—Chlorinated Lime. Sometimes improperly called chlorate of lime. A white or grayish-white, dry, or but slightly damp, powder, or friable lumps. It has the odor of chlorine, and should contain not less than 25 per cent. of available chlorine. It is produced by the action of chlorine on caustic lime.

Liquor Sodæ Chloratæ, U. S. P.—Solution chlorinated Soda. A clear, pale-greenish liquid, possessing

a faint odor of chlorine, a disagreeable and alkaline taste and an alkaline reaction. Prepared by dissolving 100 parts sodium carbonate in 400 parts of boiling water, dissolving in a separate vessel 80 parts chlorinated lime in 400 parts of water, mixing the two solutions, adding sufficient water to make 1,000 parts, straining the mixture, allowing the precipitate to subside, and drawing off and bottling the clear liquid.

The other compounds of chlorine that are of importance will elsewhere be considered.

## IODINE AND ITS COMPOUNDS.

Iodine comes in heavy, bluish-black, dry and friable rhombic plates, of a metallic luster. Like chlorine and bromine, though widely diffused, it does not occur in a free state in nature. Its salts occur in the ashes of various plants, in certain marine animals, and in solution in small quantities in sea water. It also occurs in combination with silver, lead, and saline waters in combination with sodium magnesium and potassium. It possesses a distinctive odor, sharp and acrid taste, neutral reaction. It is obtained from the mother-liquor obtained from the crystallization of sodium nitrate, in which it occurs as sodium iodide and iodate.

Officinal preparations: Liquor iodi comp., composed of iodine 5 parts, potassium iodide 10 parts, and aqua destillata 85 parts; Unguentum iodi, composed of iodine 4 parts, potassium iodide 4 parts, water 2 parts, benzoinated lard 93 parts; Tincture iodi, iodine 8 parts, alcohol

92 parts; Amylum iodatum, starch 95 parts, iodine 5 parts, water a sufficient quantity to make 100 parts.

### THE IODINE COMPOUNDS.

IODOFORM, U. S. P.—*Iodoformum.* Formed by the action of iodine on alcohol, ether and other compounds of the ether series, in the presence of a fixed alkali or an alkaline carbonate. It is in the form of small lemon-yellow, hexagonal crystals, in the form of thin, lustrous scales, unctious to the touch, with an odor resembling saffron, and a peculiar sweetish and unpleasant iodine-like taste; slightly soluble in water, soluble in 80 parts of alcohol.

Preparation: Unguentum iodoformi.

Other compounds of iodine important in pharmacy are treated under other headings.

### PHOSPHORUS.

Phosphorons exists as calcium phosphate in the bones of animals, which constitute its principal source. It is a translucent, nearly colorless solid, of a waxy luster, having the consistency of beeswax at ordinary temperature. It possesses a distinctive, disagreeable odor and taste, and is prepared by deoxidizing phosphoric acid with carbon. This is accomplished by heating acid calcium phosphate, obtained by treating calcium phosphate with sulphuric acid and charcoal. It is known in two forms.

Common phosphorus is a transparent, nearly colorless

or yellowish, highly refractive body, that crystallizes at 75° C.

Red or amorphous phosphorus is obtained by the action of heat and light on the ordinary form. If it be heated to 260° C., it changes back to the ordinary form.

Preparations: Pilulæ phosphori, U. S. P.; Oleum phosphoratum, U. S. P.

Owing to the inflammable character of phosphorus, it must be kept in a bottle well covered with water.

The compounds of phosphorus of importance in pharmacy will elsewhere be treated of.

## SULPHUR.

Sulphur is widely diffused through the world in the form of sulphates and sulphides. It also occurs in a free state. The larger amount used in medicine comes from the neighborhood of Mt. Ætna. It is usually more or less mixed with earth, but is purified by sublimation or fusion.

Roll sulphur, or brimstone, is prepared by fusing sulphur, permitting it to stand, to separate impurities, and then pouring into moulds.

Three forms of sulphur are officinal:

Sulphur Sublimatum, U. S.—Flowers of Sulphur. A fine, citron-yellow powder, of a slight characteristic odor, and generally of a faintly acid taste. It sometimes contains arsenious sulphide as an impurity. It is prepared by conducting the vapor of sulphur into a cool chamber, where it condenses in the form of a crystalline powder.

Preparation: Unguentum sulphuris, and for preparing other officinal forms of sulphur.

SULPHUR LOTUM, U. S.—Washed Sulphur. A fine, citron-yellow powder, odorless and almost tasteless. Prepared by washing sublimed sulphur with water containing ammonia, to rid it of sulphuric acid and other impurities.

Preparations: Pulv. glycyrrhizæ comp., unguentum sulphuris alkalinum, and sulphuris iodidum; prepared by fusing a mixture of one part of sulphur to four parts of iodine in a flask to a homogeneous mass.

SULHHUR PRÆCIPITATUM, U. S.—Precipitated Sulphur. A very fine, yellowish-white, amorphous powder, odorless and almost tasteless. Prepared by heating together freshly slaked lime, sublimed sulphur and water, to make a solution of calcium sulphide, then adding hydrochloric acid to precipitate the sulphur; then collecting and thoroughly washing and drying the precipitate.

## COMPOUNDS OF SULPHUR.

These are very numerous, but as most of them are treated elsewhere in these lectures, we will here mention only the following few:

HYDRO-SULPHURIC ACID, or "sulphuretted hydrogen," as it is frequently called, is a gas possessing a disagreeable odor as of decayed eggs; it is soluble in water, and poisonous when respired in the concentrated form. It precipitates many of the metals from solu-

tion, as sulphides, and is therefore valuable as a reagent in chemistry.

### THE ALKALI METALS

are potassium, sodium, lithium, rubidium and cæsium. They are characterized by their silvery-white appearance, softness, powerful affinity for oxygen, lightness—being lighter than water, on which they float and take fire spontaneously, owing to their power of decomposing that fluid.

Potassium is a widely distributed and an abundant metal. It does not occur in a free state, but in many silicates and chlorides; also in solution in small proportion in sea water and in the waters of certain mineral springs; also in the form of nitrate in various soils and other combinations in most soils, and in the tissues of land plants. It is a silver-white metal, brittle, and possessing a crystalline fracture at 75° C., but of a waxy consistency at 15° C. It oxydizes readily on exposure to damp air, and when thrown on water it oxydizes with such rapidity that the hydrogen set free by the decomposition is inflamed. It must be preserved under naptha or some other fluid that contains no oxygen. It is obtained in the metallic form by heating to a white heat a mixture of charcoal and potassium carbonate and rapidly cooling the vapor of potassium as it escapes, by conducting it into a properly constructed receiver.

### COMPOUNDS OF POTASSIUM.

Potassa, U. S.—Caustic Potash. A white, hard and dry solid, generally in the form of pencils; very deliquescent; odorless, or having a faint odor of lye; very acid and caustic taste; strongly alkaline reaction; soluble in one-half its weight in water and in twice its weight of alcohol. It is prepared from wood ashes by lixiviating, evaporating, purifying, redissolving, treating with lime, evaporating, fusing and casting into moulds.

Preparation: Liquor potassa, which contains, potassa 56 parts and aqua destillata 944 parts.

Sulphurated Potassa, U. S.—*Potassa Sulphurata.* A mixture of several compounds, produced by gradually heating a mixture of sublimed sulphur, 1 part, and potassium carbonate, 2 parts, until effervescence ceases, and cooling the fused mass by pouring on a marble slab. It occurs in irregular pieces, of a liver-brown color when freshly prepared, turning greenish-yellow or brownish-yellow. It possesses a faint, disagreeable odor, and bitter, alkaline, repulsive taste; alkaline reaction.

Potassium Acetate, U. S.—*Potassii Acetas.* A white, foliaceous, saliny, crystalline mass, or a white, granular powder, very deliquescent, odorless, warming, mildly pungent and saline taste; neutral or faintly alkaline reaction; soluble in 0.4 parts of water and 2.5 parts of alcohol; melts to an oily liquid at a temperature of about 280° C., and at a higher temperature is

decomposed. Prepared by decomposing potassium bicarbonate with acetic acid, filtering and evaporating, care being taken to avoid contact with iron.

POTASSIUM BICARBONATE, U. S.—*Potassii Bicarbonas.* Colorless, transparent, monoclinic prisms, permanent in dry air, without odor, possessing a saline and somewhat alkaline taste; feebly alkaline reaction. It gives off water and carbon dioxide when heated to 200° C., and is converted into carbonate of potassium. Prepared by passing carbon dioxide into a solution of carbonate potassium, evaporating and crystallizing.

POTASSIUM BICHROMATE, U. S.—*Potassii Bichromas.* Large orange-red, transparent, four-sided, tabular prisms, permanent in the air; odorless; bitter, disagreeable, metallic taste; acid reaction; soluble in 10 parts of water at 15° C.; fusible below red heat into a transparent red liquid, and decomposing at a white heat. Prepared by treating potassium chromate, prepared from chrome iron ore, with sulphuric acid, evaporating and crystallizing.

POTASSIUM BITARTRATE, U. S.—*Potassii Bitrartras* (Cream of Tartar). Colorless, or slightly opaque, rhombic crystals, or a white, somewhat gritty powder; permanent in the air; odorless; pleasant, acidulous taste; acid reaction. Prepared by purifying argols, a crystalline deposit found in grape juice during the vinous fermentation.

Preparations: In pulvis jalapæ comp., Beach's diaphoretic powder, and in many unofficinal mixtures.

POTASSIUM BROMIDE, U. S.—*Potassii Bromidum.* Colorless, translucent, cubical crystals; permanent in dry air; generally appearing in commerce in white, opaque or semi transparent crystals, having a faint alkaline reaction; odorless; pungent, saline taste; neutral reaction; soluble in 1.6 parts of water and 200 parts alcohol, at 15° C.

Preparations: Elixir, containing 10 grains to the fluid drachm, and in a compound solution containing bromide potassium and chloral hydrate, each 15 grains to fluid drachm, and ⅛ grain extract cannab. indica and extract hyoscyamus in water.

POTASSIUM CARBONATE, U. S.—*Potassii Carbonas* (Salts Tartar). A white crystalline or granular powder; very deliquescent at 15° C.; odorless; strong alkaline taste; alkaline reaction; soluble in 1 part water, but insoluble in alcohol. Prepared by purifying pearlash by dissolving it in cold water, filtering, evaporating and granulating.

Preparation: Unguentum sulphuris alkalinum.

POTASSIUM CHLORATE, U. S.—*Potassii Chloras.* Colorless, monoclinic prisms or plates, of a pearly luster; permanent in the air; odorless; cooling, saline taste; neutral reaction; soluble in 16.5 parts of water at 15° C., and sparingly soluble in alcohol at any temperature. When heated it fuses, gives off its oxygen, and leaves a residue of potassium chloride.

Preparations: Trochisci potassii chloratis, and an un-

officinal solution containing 30 grains of the salt to each fluid ounce of the liquid.

Caution: Potassium chlorate explodes violently when triturated with substances readily oxidizable, as sacch. album, sulphur, etc., which should never be undertaken.

POTASSIUM CITRATE, U. S.—*Potassii Citras.* A white, granular powder, deliquescent on exposure to air; odorless; slightly cooling, faintly alkaline taste; neutral or faintly alkaline reaction: soluble in 0.6 parts of water at 15° C.; loses water of crystallization at 200° C., and chars at a higher temperature. Obtained by neutralization of a solution of citric acid with potassium bicarbonate, and evaporating the solution until a granular salt remains.

Preparations: Liquor potassii citratis and mistura potassii citratis.

POTASSIUM CYANIDE, U. S.—*Potassii Cyanidum.* White, opaque, amorphous pieces, or a white, granular powder, deliquescent in damp air; colorless when perfectly dry; generally of a peculiar, characteristic odor; sharp, somewhat alkaline and bitter-almond taste; strong alkaline reaction. The fumes are poisonous when inhaled, and when taken internally acts as a violent poison. Obtained by fusing together in proper proportions dried potassium ferrocyanide and potassium carbonate.

### Questions on Lecture X.

1. What is the most important of the nitrogen compounds?
2. Which is the most important salt of boron?
3. In how many forms does borax exist?
4. Name them.
5. Does iodine occur in a free state? If so, where?
6. What is the principal source of phosphorus?
7. What are the alkaline metals?
8. To what extent is potassium acetate soluble in water.
9. Is potassii bichromas deliquescent?
10. Are the fumes of potassium cyanide poisonous?

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### Answers to Questions on Lecture IX.

1. From the different species of the genus cinchona.
2. Belladonna radix.
3. Neŭtral alkaloids,
4. By decomposition with alkalies.
5. By burning soft wood with a limited supply of air.
6. The swimming bladder of acipenser huso and other species of the same genus.
7. Inorganic acids, with the exception of the haloids.
8. Hydrogen salts.
9. A molecule of an acid.
10. a molecule of water.

# PHARMACY.

## Lecture XI.

### COMPOUNDS OF POTASSIUM—*Continued.*

POTASSIUM and SODIUM TARTRATE, U. S.—*Potassii et Sodii Tartras* (Rochelle Salts). Small white or transparent monoclinic crystals, or a white powder, somewhat deliquescent; odorless; saline, slightly bitter taste; neutral reaction; soluble in 2.5 parts of water. Prepared by saturating a solution of sodium carbonate with potassium bitartrate, evaporating the solution and crystallizing.

Preparation: Pulvis effervescens comp.

POTASSII FERROCYANIDUM, U. S.—*Ferrocyanide of Potassium.* Large, coherent, lemon-yellow, translucent, rather soft, four-sided prisms or tablets, slightly efflorescent in dry air; odorless; sweetish and saline taste; neutral reaction. Prepared by heating crude potash in covered cast-iron pots, into which is thrown a mixture of iron filings and carbonaceous matter, such as horn, feathers etc.; the fused mass is lixiviated and the clear liquid evaporated and crystallized.

POTASSIUM HYPOPHOSPHITE, U. S.—*Potassii Hypophosphis.* White, opaque, confused, crystalline masses, or white, granular powder, very deliquescent; odorless; sharp, saline, slightly bitter taste; neutral reaction; soluble in 0.6 parts of water, and 7.3 parts of alcohol. Prepared by precipitating calcium hypophosphite with potassium carbonate, filtering, evaporating and granulating, keeping it below 100° C. during the operation for fear of explosion.

POTASSIUM IODIDE, U. S.—*Potassii Iodidum.* Colorless, transparent, cubical crystals; slightly deliquescent. The commercial salt generally appears in white, opaque crystals, having a faintly alkaline reaction; but single crystals laid upon moist litmus paper should not at once produce a violet-blue stain. It melts at a dull red heat, without losing weight; it is of a peculiar faint odor, pungent, saline, afterwards somewhat bitter taste; neutral reaction; soluble in 0.8 parts of water and 18 parts of alcohol. Prepared by heating iodine in a solution of potassa, concentrating by evaporating and treating with charcoal, drying and heating to redness, dissolving in distilled water and crystallizing.

Preparations: Liquor iodinii comp., or Lugol's solution; tincture iodine comp. (U. S. P., 1870); unguentum iodi, and unguentum potassii iodidi.

POTASSIUM NITRATE, U. S.—*Potassii Nitras* (Saltpetre). Colorless, transparent six-sided rhombic prisms, or a crystalline powder, permanent in the air; odorless; cooling, saline and pungent taste; neutral re-

action. Usually obtained as a product of fermentation that takes place in soils rich in certain forms of organic matter. It is common in hot countries where it occurs as an efflorescence in the soil; this is collected and purified by repeated solution and recrystallization.

Preparations: Argenti nitras dil.; charta potassii nitratis, for preparing the purified or granular salt.

POTASSIUM PERMANGANATE, U. S.—*Potassii Permanganas.* Deep purple, violet or nearly black, needle-shaped, rhombic prisms, of a metallic lustre; permanent in the air; odorless; sweet, afterwards disagreeable, astringent taste; neutral reaction: soluble in 15 or 16 parts of water at 15° C. Usually prepared by the action of potassa and potassium chlorate on manganese dioxide.

Caution.—It must not be mixed with glycerin or similar substances, which seize upon the oxygen with such intensity as to cause explosion.

POTASSII SULPHAS, U. S.—*Sulphate of Potassium.* Colorless, hard, six-sided, rhombic prisms, permanent in the air; odorless; sharp, saline, slightly bitter taste; neutral reaction; soluble in 4 parts of water at 15° C.; much more freely soluble in boiling water, nearly insoluble in alcohol. Prepared by decomposing potassium nitrate with sulphuric acid.

POTASSIUM SULPHITE, U. S. — *Potassii Sulphis.* White, opaqe, obliquely rhombic, octohedral crystals, or a crystalline powder, somewhat deliquescent; odorless; bitter saline and sulphurous taste; freely soluble in

water, but slightly so in alcohol. Made by passing a current of sulphurous acid gas into a solution of potassium carbonate.

Potassium Tartrate, U. S.—*Potassii Tartras.* Small transparent, or white, monoclinic crystals, or a white powder, somewhat deliquescent; odorless; saline, slightly bitter taste; neutral reaction. Made by neutralizing a solution of cream of tartar with potassium carbonate.

### SODIUM.

The salts of sodium are generally more frequently used than those of potassium, because they are relatively cheaper and often more soluble. Sodium resembles potassium, and forms a similar series of compounds. Sodium does not occur native, but its compounds are abundant and widely distributed. Metallic sodium is obtained by a process similar to that employed to obtain metallic potassium, but with less difficulty.

Sodium is a white metal with a silver lustre, and at ordinary temperature has the consistency of wax; when thrown on water it is melted by the heat produced by its union with the oxygen of the water; the hydrogen thus liberated does not inflame unless the melted sodium globule be restrained from moving about, when it burns with a deep yellow-colored flame.

### THE SODIUM COMPOUNDS.

Soda, U. S.—*Soda* (Caustic Soda). A white, hard, opaque solid, generally in the form of fibrous pieces, or

of white cylindrical pencils, deliquescent in moist air, but in dry air it becomes dry and efflorescent; it is odorless, with an intensely acrid and caustic taste, and strong alkaline reaction; soluble in 1.8 parts of water at 15° C.; freely soluble in alcohol. Prepared by boiling a solution of sodium carbonate with calcium hydrate and evaporating.

Preparation: Liquor sodæ.

LIQUOR SODÆ, U. S.—*Solution of Soda.* A clear, colorless liquid, consisting of hydrate of sodium about 5 per cent.; odorless, with an acrid and caustic taste, and strong alkaline reaction. Prepared by decomposing the carbonate by heating it with an aqueous mixture of calcium hydrate, or by dissolving sodium hydrate in water.

LIQUOR SODÆ CHLORATÆ, U. S.—*Solution of Chlorinated Soda.* Made by double decomposition between chlorinated lime and sodium carbonate.

SODII ACETAS, U. S.—*Acetate of Sodium.* Large, colorless, transparent, monoclinic prisms; efflorescent in dry air; odorless; with a saline, bitter taste, and neutral or faintly alkaline reaction. Prepared by decomposing sodium carbonate with acetic acid.

SODII ARSENIAS, U. S.—*Arseniate of Sodium.* Colorless, transparent, prismatic crystals: slightly efflorescent in dry air; odorless; with a mild, feebly alkaline taste, and faintly alkaline reaction; somewhat deliquescent; soluble in 4 parts of water at 15° C.; is poisonous. Prepared by fusing together in proper propor-

tions sodium carbonate and sodium nitrate with arsenious acid, treating the fused mass with water and crystallizing.

Preparation: Liquor sodii arsenatis.

SODIUM BENZOATE, U. S.—*Sodii Benzoas.* A white, semi-crystalline or amorphous powder; efflorescent on exposure to air; odorless, or having a faint odor of benzoin; sweetly astringent taste, free from bitterness; neutral reaction; soluble in 1.8 parts of water at 15° C. Prepared by neutralizing a solution of benzoic acid with sodium carbonate, the liquid evaporated and allowed to crystallize, or evaporated to dryness and the salt obtained as granulated.

SODIUM BICARBONATE, U. S.—*Sodii Bicarbonas.* A white, opaque powder, permanent in the air; odorless; cooling, mild saline taste, and slight alkaline reaction; soluble in 12 parts of water at 15° C.; insoluble in alcohol. Prepared by exposing the carbonate to carbon dioxide.

Preparations: Mistura rhei et sodæ; pulv. effervescence comp.; trochisi sodii bicarbonatis.

SODIUM BISULPHITE, U. S.—*Sodii Bisulphis.* Opaque, prismatic crystals, or a crystalline or granular powder; slowly oxydizing and losing sulphurous acid on exposure to air; faint sulphurous odor; disagreeable sulphurous taste; acid reaction; soluble in 4 parts of water; much less soluble in alcohol. Prepared by saturating a cold solution of sodium carbonate with sulphurous acid gas.

SODIUM BORATE, U. S.—*Sodii Boras.* Colorless, transparent, shining, monoclinic prisms; slightly efflorescent in dry air; odorless; mild, cooling, sweetish, afterwards somewhat alkaline taste; alkaline reaction. Prepared by purifying the natural salt found in large quantities in California and other places.

SODIUM BROMIDE, U. S.—*Sodii Bromidum.* Small, colorless, or white monoclinic crystals, or a crystalline powder; permanent in dry air; odorless, saline, slightly bitter taste, neutral or faintly alkaline reaction; soluble in 1.2 parts of water, and in 13 parts of alcohol. Prepared in a manner similar to potassium bromide.

SODIUM CARBONATE, U. S.—*Sodii Carbonas.* Large, colorless, monoclinic crystals; rapidly efflorescent in dry air, and falling into a white powder; odorless; sharp alkaline taste; alkaline reaction; soluble in 1.6 parts of water; insoluble in alcohol. Prepared artificially and found in many mineral waters. (See U. S. D.)

Preparations: Sodii carbonas exc. A white hygroscopic powder, made by heating the carbonate to a temperature of 45° C.

SODIUM CHLORATE, U. S.—*Sodii Chloras.* Colorless, transparent, tetrahedral crystals; permanent in dry air; odorless; cooling, saline taste; neutral reaction. If triturated with organic or other easily oxydizable compounds, explosion is likely to occur. Process of obtaining is similar to that employed to obtain potassium chlorate.

SODIUM CHLORIDE, U. S.—*Sodii Chloridum* (Com-

mon Salt). White, shining, hard, cubical crystals, or a crystalline powder; permanent in the air; odorless; purely saline taste; neutral reaction. Obtained by evaporating sea water, and the salt from salt wells, springs, etc.

SODII HYPOPHOSPHIS, U. S.—*Hypophosphite of Sodium.* Small, colorless or white, rectangular plates, or a white, granular powder; deliquescent on exposure to the air; odorless; sweetish, saline taste; neutral reaction; soluble in 1 part of water and 30 of alcohol. Prepared by double decomposition between calcium hypophosphite and sodium carbonate.

SODIUM HYPOSULPHITE, U. S.—*Sodii Hyposulphis.* Large, colorless, transparent, monoclinic prisms or plates; efflorescent in dry air; odorless; cooling, somewhat bitter and sulphurous taste; neutral or faintly alkaline reaction; soluble in 1.5 parts of water and insoluble in alcohol. Prepared by decomposing calcium thiosulphate with sodium sulphate.

SODIUM IODIDE, U. S.—*Sodii Iodidum.* Minute, colorless or white, monoclinic crystals, or a crystalline powder; deliquescent on exposure to air; odorless; saline and slightly bitter taste; neutral or faintly alkaline reaction; soluble in 6 parts of water and 1.8 parts of alcohol. Prepared by treating ferrous iodide with sodium carbonate.

SODIUM NITRATE, U. S.—*Sodii Nitras.* Colorless, transparent, rhombohedral crystals; slightly deliquescent in damp air; odorless; cooling, saline and slightly

bitter taste; neutral reaction; soluble in 1.3 parts of water and nearly insoluble in alcohol. Found in Chili and Peru.

SODIUM PHOSPHATE, U. S.—*Sodii Phosphas.* Large, colorloss, transparent, monoclinic prisms; speedily efflorescing and becoming opaque on exposure to air; odorless; cooling, saline and feebly alkaline taste; slightly alkaline reaction; soluble in 6 parts of water and insoluble in alcohol; is converted into pyrophosphate at a temperature of 300° C. Prepared by treating acid calcium phosphate with sodium carbonate.

SODIUM PYROPHOSPHATE, U. S.—*Sodii Pyrophosphas.* Colorless, translucent, monoclinic prisms; permanent in the air; odorless; cooling, saline and feebly alkaline taste; slight alkaline reaction. Prepared from the phosphate, (see above).

SODIUM SALICYLATE, U. S. — *Sodii Salicylas* Small, white, crystalline plates, or a crystalline powder; permanent in the air; odorless: sweetish, saline and mildly alkaline taste; feeble acid reaction; soluble in 2.5 parts of water and in 6 parts of alcohol. Prepared by reaction of salicylic acid on sodium carbonate in water.

SODIUM SANTONINATE, U. S.—*Sodii Santoninas.* Colorless, transparent, tabular, rhombic crystals, slowly colored yellow by exposure to light; slightly efflorescent in dry air; odorless; mildly saline and somewhat bitter taste; slight alkaline reaction; soluble in 3 parts of water and 12 parts of alcohol. Prepared by reaction of soda on santonine in water and crystallizing the salt.

SODIUM SULPHATE, U. S.—*Sodii Sulphas.* Large, colorless, transparent, monoclinic prisms; rapidly efflorescent on exposure to the air, and ultimately falling into a white powder; soluble in 2.8 parts of water, insoluble in alcohol; odorless; cooling, saline and somewhat bitter taste, and neutral reaction. Prepared by decomposing sodium carbonate with sulphuric acid.

SODII SULPHOCARBOLAS, U. S.—*Sulphocarbolate of Sodium.* Colorless, transparent, rhombic prisms; permanent in the air; odorless, or nearly so; cooling, saline, somewhat bitter taste; neutral reaction. Prepared by double decomposition between barium sulphocarbolate and sodium carbonate.

SODIUM SULPHITE, U. S.—*Sodii Sulphis.* Colorless, transparent, monoclinic prisms; efflorescent in dry air; odorless, cooling, saline and sulphurous taste, neutral or faintly alkaline reaction; soluble in 4 parts of water, but slightly soluble in alcohol.

## COMPOUNDS OF LITHIUM.

Lithium does not exist in nature in a free state, and its compounds are less abundant than those of sodium or potassium. It occurs in certain minerals, and in certain mineral springs, sea waters and most fresh waters, though in minute quantities. It also occurs in plants. The metal is obtained from the chloride by electrolysis, but is too expensive to be more than a scientific curiosity.

LITHIUM BENZOATE, U. S.—*Lithii Benzoas.* A powder, or small, shining scales; permanent in the air; odorless, or having a faint benzoin-like odor; cooling and sweetish taste, and a faint acid reaction. Prepared by decomposing the carbonate with benzoic acid.

LITHIUM BROMIDE, U. S.—*Lithii Bromidum.* A white, granular salt; very deliquescent; odorless; very sharp, somewhat bitter taste, and neutral reaction. Prepared by decomposing the carbonate with hydrobromic acid.

LITHIUM CARBONATE, U. S.—*Lithii Carbonas.* A light, white powder; permanent in the air, odorless; alkaline taste, and alkaline reaction. Prepared by treating a solution of the chloride with ammonium carbonate.

LITHIUM CITRATE, U. S.—*Lithii Citras.* A white powder; deliquescent when exposed to the air; odorless; slightly cooling, faintly alkaline taste, and neutral reaction. Prepared by treating a saturated solution of the carbonate with citric acid.

LITHIUM SALICYLATE, U. S.—*Lithii Salicylate.* A white powder; deliquescent on exposure to the air; odorless, or nearly so; sweetish taste; faintly alkaline reaction. Prepared by the reaction of salicylic acid on the carbonate.

## THE COMPOUNDS OF MAGNESIUM.

Magnesium is an abundant metal, yet it is not found in nature in a free state. It occurs in some minerals

and in many saline springs and in sea waters, also in the bones of animals and the tissue of plants.

MAGNESIA, U. S.—*Magnesia* (Light Magnesia). A white, very light and fine powder; slowly absorbing carbonic acid from the air; odorless; an earthy, but no saline, taste; faintly alkaline reaction when moistened with water; should be kept in tightly stopped bottles. Prepared by calcining light magnesium carbonate.

MAGNESIUM CARBONATE, U. S.—*Magnesii Carbonas.* Light, white, friable powder masses, or a light, white powder; odorless; tasteless, and faint alkaline reaction. Prepared by double decomposition between magnesium sulphate and sodium carbonate.

Preparations: Mistura magnesiæ et asafœtidæ; magnesia citras gran., and liquor magnesiæ citratis.

MAGNESIUM SULPHATE, U. S.—*Magnesii Sulphas* (Epsom Salts). Small, colorless, right rhombic prisms, or acicular needles; slowly effervescent in dry air; odorless; cooling, saline and bitter taste; neutral reaction. Prepared by treating native magnesia hydrate with sulphuric acid.

Preparation: Infusum sennæ comp.

## COMPOUNDS OF CALCIUM.

Calcium abounds in nature, and is represented by a large number of compounds, which constitute a considerable portion of the earth's crust; but the metal itself is seldom seen outside the chemical laboratory.

CALX, U. S.—*Lime.* Hard, white, or greyish white, masses; gradually attracting moisture and carbonic gas on exposure to air, and falling to a white powder; odorless; sharp, caustic taste, and alkaline reaction; soluble in 750 parts cold water. Prepared by calcining limestone or chalk.

Preparations: Liquor calcis, potassa cum calce; linimentum calcis, and syrup calcis.

CALCIUM BROMIDE, U. S.—*Calcii Bromidum.* A white, granular salt; very deliquescent; odorless; pungent, saline and bitter taste, and neutral reaction; soluble in 0.7 parts of water and 1 part of alcohol.

PRECIPITATED CALCIUM CARBONATE, U. S.—*Calcii Carbonas Præcipitatus.* A very firm, white, impalpable powder; permanent in the air; odorless and tasteless, and neütral reaction. Prepared by double decomposition between calcium chloride and sodium carbonate.

PREPARED CHALK, U. S.—*Creta Præparata* (Native Calcium Carbonate). A white, amorphous powder, generally in the form of small cones; permanent in the air, odorless and tasteless. Prepared from the native friable carbonate of calcium by elutriation.

CALCIUM HYPOPHOSPHITE, U. S.—*Calcii Hypophosphis.* Colorless or white, six-sided prisms, or thin, flexible scales, of a pearly lustre; permanent in the air; odorless; nauseous, bitter taste, and neutral reaction. Prepared by heating phosphorus with milk of lime.

Calcium Chloride, U. S.—*Calcii Chloridum.* Colorless, slightly translucent, hard and friable masses; very deliquescent.

Precipitated Calcium Phosphate, U. S.—*Calcii Phosphas Præcipitatus.* A light, white, amorphous powder; permanent in the air; odorless and tasteless. Prepared by treating bone ash with hydrochloric acid and precipitating it with ammonia.

Preparations: Pulvis antimonialis and syrup calcii lactophosphatis.

### COMPOUNDS OF ALUMINUM.

Aluminum, with the exception of silicon and oxygen, is the most abundant and widely distributed of the elements. It is a tin-white metal, very malleable and ductile.

Alum, U. S.—*Alumen.* Large, colorless, octohedral crystals; sometimes, modified by cubes, it acquires a white coating on exposure in the air; odorless; sweetly astringent taste and acid reaction. Prepared by treating alum clay with sulphuric acid and potassium sulphate.

Aluminii Sulphas, U. S.—*Sulphate of Aluminum.* A white, crystalline powder; permanent in the air: sweetish, and afterwards astringent, taste; acid reaction. Prepared by treating aluminum hydrate with sulphuric acid and crystallizing.

### COMPOUNDS OF ZINC.

Zinc, though abundant, rarely occurs uncombined.

ZINC ACETATE, U. S.—*Zinci Acetas.* Soft, white, micaceous or pearly, six-sided tablets or scales; somewhat efflorescent in dry air; faintly acetous odor; sharp, metallic taste, and slight acid reaction. Prepared by heating zinc oxide with acetic acid.

ZINC BROMIDE, U. S.—*Zinci Bromidum.* A white, or nearly white, granular powder; very deliquescent; odorless; sharp, saline and metallic taste, and neutral reaction. Prepared by treating granulated zinc with hydrobromic acid.

ZINC CHLORIDE, U. S.—*Zinci Chloridum.* A white, crystalline powder, or white, opaque pieces; very deliquescent; odorless; caustic, saline and metallic taste, and acid reaction. Prepared by evaporating the officinal solution of chloride of zinc.

ZINC IODIDE, U. S.—*Zinci Iodidum.* A white, or nearly white, granular powder; very deliquescent: odorless; sharp, saline and metallic taste; acid reaction. Prepared by the action of iodine on zinc in the presence of water.

ZINCI OXIDUM, U. S.—*Oxide of Zinc.* A soft, pale yellowish, nearly white powder; permanent in the air; odorless and tasteless. Prepared by calcining zinc carbonate.

ZINC SULPHATE, U. S.—*Zinci Sulphas.* Small, colorless, right-rhombic prisms, or acicular needles; slowly efflorescing in dry air; odorless; sharp, saline, nauseous and metallic taste and acid reaction. Prepared by the action of diluted sulphuric acid on zinc.

ZINC VALERIANATE, U. S.—*Zinci Valerianas.* Soft, white, pearly scales; permanent in the air; faint odor of valerianic acid; sweet, afterward styptic and metallic taste; acid reaction. Prepared by double decomposition of zinc sulphate and sodium valerianate.

### COMPOUNDS OF MANGANESE.

A metal belonging to the iron group. The metal itself has no pharmaceutical uses.

MANGANESE DIOXIDE, U. S.—*Mangani Oxidum Nigrum.* A heavy, grayish-black, more or less gritty powder; permanent in the air; odorless and tasteless; consisting of native crude binoxide of manganese, containing 66 per cent. of the pure oxide.

MANGANESE SULPHATE, U. S.—*Mangani Sulphas.* Colorless, or pale rose colored, transparent, right-rhombic prisms; odorless; slightly bitter and astringent taste, and faint acid reaction. Prepared by reaction of sulphuric acid on manganese dioxide.

### CERIUM.

CERII OXALAS, U. S.—*Oxalate of Cerium.* A white, slightly granular powder; permanent in the air; odorless and tasteless. Prepared by precipitating cerium chloride with oxalic acid.

### COMPOUNDS OF IRON.

The oxides and carbonates of iron are very abundant. The metal is too familiarly known to need a description.

Ferrum Reductum, U. S.—*Reduced Iron.* A very fine, grayish-black, lustreless powder; permanent in dry air; without odor or taste. Prepared by passing hydrogen over subcarbonate of iron, heated in a reduction tube.

Ferric Chloride, U. S.—*Ferri Chloridum.* Orange-yellow, crystalline pieces; very deliquescent; odorless, or having a faint odor of hydrochloric acid; strong styptic taste, and acid reaction. Prepared by the action of hydrochloric and and nitric acids on iron.

Ferric Citrate, U. S.—*Ferri Citras.* Transparent, garnet-red scales; deliquescent on exposure to damp air; odorless; saline, mildly ferruginous taste; neutral reaction. Prepared from the solution of the citrate by evaporation.

Ferri et Ammonii Citras.—*Citrate of Iron and Ammonium.* Prepared by adding water of ammonia to solution of ferric citrate, evaporating and scaling.

The following are made from this salt: Ferri et strychninæ citras, Liquor ferri et quininæ citratis, Vinum ferri amarum, Vinum ferri citratis.

Citrate of Iron and Quinine, U. S.—*Ferri et Quininæ Citras.* Transparent, thin scales; reddish-brown; slowly deliquescent on exposure to air; odorless; bitter and mildly ferruginous taste; slight acid reaction. Prepared by dissolving alkaloidal quinine in solution of ferric citrate, evaporating and scaling.

Tartrate of Iron and Potassium, U. S.—*Ferri et Potassii Tartras.* Transparent, garnet-red scales;

only slightly deliquescent; odorless; sweetish, slightly ferruginous taste; neutral reaction. Prepared by adding to ferric hydrate, acid potassium tartrate and a trace of water of ammonia and scaling.

IODIDE OF IRON, U. S.—*Ferri Iodidum.* Prepared by the reaction of iodine upon iron in the presence of water until the mixture has lost the smell of iodine and acquired a green color, when it contains ferrous iodide in solution.

FERRI IODIDUM SACCHARATUM, U. S.—*Saccharated Ferrous Iodide.* Is prepared by filtering the solution of ferrous iodide into milk sugar and evaporating to dryness. It should contain 20 per cent. of the iodide.

Syr. iodide of iron is prepared by filtering the solution of ferrous iodide into hot syrup. It should contain 10 per cent. of ferrous iodide.

FERRIC HYDRATE, U. S.—*Ferri Oxidum Hydratum.* Prepared by mixing a solution of tersulphate of iron with ammonia and thoroughly washing the precipitate. It should always be freshly prepared.

FERRIC PYROPHOSPHATE, U. S.—*Ferri Pyrophosphas.* Thin, apple-green, transparent scales; permanent in dry air, when excluded from light, but turning dark on exposure to light; odorless; acidulous, slight saline taste, and slight acid reaction. Prepared by mixing solutions of citrate of iron and pyrophosphate of sodium, evaporating in scales.

FERRIC VALERIANATE, U. S.—*Ferri Valerianas.* A dark, tile-red, amorphous powder; permanent in dry

air; faint odor of valerian; acid, mildly styptic taste. Prepared by double decomposition between ferric sulphate and sodium valerianate.

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## Questions on Lecture XI.

1. Potassium and sodium tartrate is commonly known by what name?
2. At what temperature should potassium hypophosphate be kept during the process of making, and why?
3. Should iodide of potassium produce an immediate effect when placed upon wet litmus paper?
4. Should permanganate of potassium be dispensed in glycerin?
5. Why?
6. Are the salts of sodium more frequently used than those of potassium?
7. Why?
8. Ferric pyrophosphate is prepared how?
9. Does zinc occur in a free and uncombined state?
10. To what group of metals does manganese belong?

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## Answers to Questions on Lecture X.

1. Ammonia.
2. Borax.

3. Three.
4. Amorphous, crystalline and graphitoidal.
5. No.
6. Bones of animals.
7. Potassium, sodium, lithium, rubidium and cæsium.
9. No.
10. Yes.

# PHARMACY.

## Lecture XII.

### TIN.

Tin is principally found in tinstone. There are no officinal preparations of this metal, and it is of no interest pharmaceutically; but its salts are of importance in the arts. It is a brilliant, lustrous, white metal, melting at 235° C. It exhibits a fibrous fracture, when bent producing a crackling sound. It is somewhat harder than lead, malleable and ductile, but not tenacious. All the preparations of it are poisonous.

### COMPOUNDS OF LEAD.

Lead is obtained by roasting the native sulphide. It is a heavy, soft, bluish metal. Though its ores are abundant it is seldom found free in nature. Lead and its compounds are poisonous.

Lead is a soft metal, with a metallic luster and a blue-gray color; ductile and malleable, but not very

tenacious; quite soft, melting at .325° C. Its soluble compounds are all poisonous.

LEAD ACETATE, U. S.—*Plumbi Acetas* (Sugar of Lead). Colorless, shining, transparent, prismatic crystals or scales;. efflorescent and absorbing carbonic acid on exposure to air; it possesses a faint acetous odor; sweetish, astringent, afterwards metallic taste, and faint acid reaction. Prepared by treating lead oxide with acetic acid, evaporating and crystallizing. The commercial salt is unfit for use.

SUBACETATE OF LEAD (Solution), U. S.—*Liquor Plumbi Subacetatis.* A clear, colorless liquid, of a sweetish, astringent taste and alkaline reaction. Prepared by boiling solution of lead acetate with lead oxide. It contains 25 per cent. of the salt.

Used in the following officinal preparations: Liquor plumbi subacetatis dilutus, linimentum plumbi subacetatis, ceratum plumbi subacetatis.

LEAD CARBONATE, U. S.—*Plumbi Carbonas* (White Lead). A heavy, white, opaque powder or pulverulent mass; permanent in the air; odorless and tasteless.

Preparations: Unguentum plumbi carbonatis.

Prepared by the action of carbonic acid on the acetate.

LEAD IODIDE, U. S.—*Plumbi Iodidum.* A heavy, bright, citron-yellow powder; permanent in the air; odorless, tasteless, and having a neutral reaction.

Preparation: Unguentum plumbi iodidi.

Prepared by the double decomposition between lead nitrate and potassium iodide.

Lead Nitrate, U. S.—*Plumbi Nitras.* Colorless, transparent or white, nearly opaque, octahedral crystals; permanent in the air; odorless; sweetish, astringent, afterwards metallic taste, and acid reaction; soluble in 2 parts of water, and nearly insoluble in alcohol at 15° C. Prepared by treating lead oxide with diluted nitric acid, evaporating and crystallizing.

Lead Oxide, U. S.—*Plumbi Oxidum* (Litharge). A heavy, yellowish or reddish-yellow powder or minute scales; permanent in the air; odorless; tasteless.

Preparations: Liquor plumbi subacetatis, emplastrum plumbi.

Prepared by roasting lead ore.

## COMPOUNDS OF COPPER.

Copper is very abundant, both native and combined. It is a red metal, with a bright metallic luster, tough, malleable and ductile. Most of its compounds are poisonous.

Copper Acetate, U. S.—*Cupri Acetas* (Verdigris). Dark green prismatic crystals, yielding a bright green powder; efflorescent on exposure to air; odorless; nauseating, metallic taste and acrid reaction. Prepared by treating copper with acetic acid and crystallizing.

Copper Sulphate, U. S.—*Cupri Sulphas* (Blue Vitriol). Large, transparent, deep-blue, triclinic crystals; efflorescent; odorless; nauseous, metallic taste; acid reaction. Obtained by oxidizing the sulphide, or by the action of sulphuric acid on the metal.

## COMPOUNDS OF SILVER.

Silver occurs both in a free and in a combined state. It is a bright, white metal, tenacious, malleable and very ductile.

SILVER CYANIDE, U. S.—*Argenti Cyanidum.* A white powder, permanent in dry air, but turning brown on exposure to light; odorless and tasteless; insoluble in water and alcohol. Prepared by passing hydrocyanic gas into a solution of silver nitrate.

SILVER IODIDE, U. S.—*Argenti Iodidum.* A heavy, amorphous, light-yellowish powder; if pure, it is unaltered by light, generally becoming somewhat greenish-yellow; odorless and tasteless; insoluble in water and alcohol. Prepared by mixing a solution of silver nitrate with one of potassium iodide.

SILVER NITRATE, U. S.—*Argenti Nitras.* olorless, transparent, tabular, rhombic crystals, becoming gray or grayish-black on exposure to light in the presence of organic matter; odorless; bitter, caustic and strongly metallic taste and neutral reaction; soluble in less than its own weight of water, sparingly soluble in cold alcohol. Prepared by treating silver with dilute nitric acid.

It is used in preparing the following officinal prepations: Argenti nitras dilutus, argenti nitras fusus.

SILVER OXIDE, U. S.—*Argenti Oxidum.* A heavy, hard, brownish-black powder; odorless; metallic taste.

Prepared by adding a solution of silver nitrate into one of lime or of caustic potash.

### COMPOUNDS OF MERCURY.

Mercury is the only metal that is liquid at ordinary temperature. It is sometimes found in a free state, but is usually obtained from its ores by roasting. It is a silvery, mobile liquid, solidifying at 39°.44 C., boiling at 357°.2 C. It forms two series of salts—the mercurous and mercuric.

MASSA HYDRARGYRI, U. S. Contains one-third of its weight of mercury, combined with hecovis, honey, etc.

HYDRARGYRUM CUM CRETA, U. S. Contains 38 per cent. of mercury, combined with chalk, sugar of milk, etc.

UNGUENTUM HYDRARGYRI, U. S. Contains one-half its weight of mercury.

EMPLASTRUM HYDRARGYRI, U. S. Contains 30 per cent. of mercury.

EMPLASTRUM AMMONIACI CUM HYDRARGYRO, U. S. Contains 18 per cent. of mercury.

AMMONIATE MERCURY, U. S.—*Hydrargyrum Ammoniatum* (White Precipitate). White, pulverulent pieces, or a white powder; permanent in the air; odorless and tasteless. Prepared by decomposing a solution of mercuric chloride by ammonia water in excess, collecting and washing the precipitate.

Preparation: Unguentum hydrargyri ammoniati, U. S., strength 10 per cent.

MERCURIC CHLORIDE, U. S.—*Hydrargyri Chloridum Corrosivium* (Corrosive Sublimate). Heavy, colorless, rhombic crystals, or crystalline masses; permanent in the air; odorless; acrid and metallic taste, and acid reaction; soluble in 16 parts of water at 15° C., and 3 parts of alcohol at the same temperature. It is a powerful irritant poison; antidote, white of an egg or milk. Prepared by the double decomposition of mercuric sulphate and sodium chloride.

MERCUROUS CHLORIDE, U. S.—*Hydrargyrum Chloridum Mite* (Calomel). A white, impalpable powder; permanent in the air; odorless and tasteless. Prepared by double decomposition of mercurous sulphate and sodium chloride.

Preparations: Pilulæ antimonii comp., pilulæ catharticæ comp.

MERCURIC CYANIDE, U. S.—*Aydrargyri Cyanidum.* Colorless or white prismatic crystals, becoming colored on exposure to light; odorless; bitter, metallic taste, and neutral reaction; soluble in 12.8 parts of water and 15 parts of alcohol at ordinary temperature; is very poisonous. Prepared by dissolving mercuric oxide in hydrocyanic acid.

MERCURIC IODIDE., U. S.—*Hydrargyri Iodidum Rubrum.* A scarlet-red, crystalline powder; permanent in the air; odorless and tasteless; insoluble in water, and soluble in 130 parts of alcohol; a powerful

poison. Prepared by the reaction of potassium iodide and mercuric chloride in solution.

Preparation: Liquor arsenii et hydrargyri iodidi.

Mercurous Iodide, U. S.—*Hydrargyri Iodidum Viride* (Protiodide of Mercury). A dark green or greenish-yellow powder, becoming more yellow by exposure to air, and darker by exposure to light; odorless and tasteless; insoluble in alcohol, nearly so in water. Prepared by the direct union of mercury and iodine.

Yellow Mercuric Oxide, U. S.—*Hydrargyri Oxidum Flavum.* A light orange-yellow, heavy, impalpable powder; permanent in the air, but turning dark on exposure to light. Prepared by mixing solutions of mercuric chloride and potassa, and collecting, thoroughly washing and drying the precipitate.

Preparations: Oleatum hydrargyri, unguentum hydrargyri oxidi flavi.

Red Mercuric Oxide, U. S.—*Hydrargyri Oxidum Rubrum* (Red Precipitate). Heavy, orange-red, crystalline scales, or a crystalline powder, becoming more yellow the finer it is divided; permanent in the air; odorless and tasteless. Prepared by decomposing the nitrate by heat.

Preparations: Unguentum hydrargyri oxidi rubri.

Mercuric Nitrate, U. S.—*Hydrargyri Nitras.* Prepared by dissolving red oxide of mercury in nitric acid; is officinal in the form of liquor hydrargyri nitratis, containing 50 per cent. by weight of mercuric nitrate.

UNGUENTUM HYDRARGYRI NITRATIS (Citrine Ointment). See Ointments.

## COMPOUNDS OF ANTIMONY.

Antimony, in a metallic state, rarely occurs native. It is a lustrous metal, silver white, of a crystalline structure, and brittle at ordinary temperature. Its soluble compounds are all poisonous.

Several preparations of antimony are officinal, but the following are of most importance to pharmacy:

TARTRATE OF ANTIMONY AND POTASSIUM, U. S.—*Antimonii et Potassii Tartras.* Colorless, transparent crystals, becoming white and opaque on exposure to the air; odorless; having a sweetish and afterwards a disagreeable metallic taste; soluble in 17 parts of water, insoluble in alcohol. Prepared by the action of acid tartrate of potassium on oxide of antimony.

Preparations: Syrupus Scillæ comp.; vinum antimonii.

ANTIMONII OXIDUM, U. S.—*Oxide of Antimony.* A heavy, grayish powder, permanent in the air; odorless and tasteless.

Preparation: Tartar emetic.

It exists in nature as the mineral cervatite.

## COMPOUNDS OF ARSENIC.

Arsenic occurs in nature both in a free and in a combined state. The arsenic of commerce is either native or derived from arsenical pyrites by heating in an earthenware tube in a furnace. Arsenic and all of its

compounds are poisonous. In the ordinary form it has a steel-gray color, and sometimes a metallic luster. Several of its compounds have been mentioned elsewhere, and we mention here only the following:

ARSENIC IODIDE, U. S.—*Arsenii Iodidum.* Glossy, orange-red, crystalline masses, or shining, orange-red crystalline scales, gradually losing iodine when exposed to the air; odor similar to iodine; iodine-like taste; neutral reaction; soluble in 3.5 parts water and 10 parts of alcohol. Prepared by fusing 1 part of arsenic and 5 parts of iodine together.

Preparation: Liquor arsenici et hydrargyri iodidi.

ARSENIC OXIDE. A white salt, deliquescent in moist air, forming arsenic acid; seldom used in medicine.

ARSENIOUS CHLORIDE. A poisonous, oily-looking liquid.

ARSENIOUS BROMIDE. A colorless, crystalline, poisonous salt.

These compounds are of little importance in pharmacy.

## COMPOUNDS OF BISMUTH.

Bismuth exists in a metallic state in some localities; the commercial supply is generally derived from the mines in Saxony. It is hard, brittle, bright; metallic luster; of crystalline structure; grayish, with a reddish tinge.

BISMUTH CITRATE, U. S.—*Bismuthi Citras.* A white, amorphous powder, permanent in the air; odor-

less and tasteless; insoluble in water and alcohol, soluble in aqua ammoniæ. Prepared by boiling the subnitrate in a solution of citric acid.

BISMUTH AND AMMONIUM CITRATE, U. S.—*Bismuthi et Ammonii Citras.* Small, shining, pearly or translucent scales, becoming opaque on exposure to air; odorless; slightly acidulous and metallic taste; neutral or faintly alkaline reaction, soluble in water, but sparingly so in alcohol. Prepared by dissolving bismuth citrate in water of ammonia, evaporating the solution and scaling.

Liquor bismuthi contains two grains of the ammonio-citrate in each fluid drachm.

BISMUTH SUBCARBONATE, U. S.—*Bismuthi Subcarbonas.* A white, or pale yellowish-white powder, permanent in the air; odorless and tasteless; insoluble in water and alcohol. Prepared by dissolving bismuth in nitric acid, precipitating by adding solution of sodium carbonate.

BISMUTH SUBNITRATE, U. S.—*Bismuthi Subnitras.* A heavy, white powder, permanent in the air; odorless; almost tasteless; slightly acid reactton; insoluble in water and alcohol. Prepared by dissolving the metal in nitric acid, pouring the concentrated solution in distilled water, and collecting the precipitate.

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Having treated the various substances of the U. S. P. in as exhaustive a manner as space would permit,

we will now direct the student's attention to the most important subject connected with pharmacy, viz.:

### DISPENSING.

With this subject is connected that of the organization of a store. As space will not admit of a description here, we refer the student to the various works on pharmacy. The selection of a proper location for establishing a pharmacy is a most important and responsible duty. As Prof. Remington says, "every pharmacist should select the location in which he will be most likely to achieve the greatest amount of success." But other points of equal importance arise, viz.: As the advantages derived from the presence of light and ventilation, the disadvantage of exposure from dust of the street and the necessary depreciation of stock, and many other minor points.

A pharmacy should be arranged from a dispensing standpoint. As the operations in compounding prescriptions require the closest attention, they should always be performed where the greatest freedom from interruption can be secured. Particular attention should be given to the arranging of the containers with the view to prevent mistaking one substance for another. The nomenclature of the labels should also receive special attention, and should be perfect in every instance. "A strict adherence to the pharmacopœial nomenclature, with a faultless abbreviation on all containers, will not only tend to guard against errors in

dispensing, but is also desirable because of its great convenience.

The isolation of poisons seems to be the most practicable and safest method for preventing mistakes in dispensing,

The preservation of medicinal substances is also a question of vast importance to the pharmacist. Many of them, under certain conditions, as exposure to light, dampness, etc., deteriorate and frequently spoil.

The dispensing of liquids (the introduction of parts by weight in the U. S. P. to the contrary notwithstanding), except in a few, such as glycerin, ether, etc., is done by measure.

Confusion will often be obviated if the dispenser will first ascertain that every article required for its completion is on hand.

Always provide a container with a good cork fitted accurately.

"*In measuring* a liquid into a 'graduate' from a shelf bottle, care should be observed that:

"(1). The measure be held by grasping the foot or base firmly between the thumb and the index finger of the left hand and bringing it up so as to be on a level with the eye.

"(2). The container is taken down from the shelf, after the label has first been carefully read, with the right hand placed near the bottom.

"(3). The stopper is then tightly grasped between the

free little finger and left hand, extracted, and the contents poured into the measure with great exactness.

"(4). The remaining drop upon the lip of the bottle is then by a dextrous movement wiped off on the stopper, the latter inserted, and the container placed back on the shelf after again carefully reading the label.

"(5). The liquid, having been poured in the bottle, is carefully stopped with a cork, the top extending so that it may be easily extracted with the fingers, but yet so secure that any jolting the package may receive will not be sufficient to dislodge it."

Labeling is also an important part of dispensing. The label should be plain and neat, and printed in black ink, except with those of poisons, which should be in red ink. When blank labels are used they should be written in a bold and legible handwriting, without flourish, and should contain such information as may be desirable for an intelligent use of the article.

The label should be affixed so that the center of the label will be about three-fifths the distance from the bottom of the bottle, and should never be placed across the seams on round vials.

In wrapping packages always select suitable paper and that of proper size; never use paper with ragged edges. See that it is properly folded, so that the center of the crease will be exactly in the center of the package, and the ends, when folded over, present a perfectly square edge. It should be properly labeled and securely tied.

## PRESCRIPTIONS.

Prescription is literally a written order for something relating to medicine. It may be defined as the formula which a physician writes, specifying the substance he intends to administer to a patient.

The Latin language is employed from the fact that it is the language of science, and is a dead language and not subject to changes that are common to all forms of living speech.

The quantities of substances to be used in compounding a prescription are always expressed in the Roman numerals.

A prescription may be divided into six parts, as follows: First, the heading; second, the name of the patient; third, the inscription, or the names and quantities of the ingredients; fourth, the subscription, or the directions to the compounder; fifth, the signa, or directions for the patient; sixth, the name or initials of the physician, and date.

The compounding of prescriptions is the most responsible duty of the pharmacist; not only because it involves professional skill, but also a good judgment and a collected mind. The greatest care, accuracy and skill may be displayed in compounding a mixture, when in a moment of absent-mindedness an error may be committed in writing the directions on the label, or delivering the medicine to the wrong party, that may prove fatal. In no other profession does so great a responsibility exist as that which surrounds the pharma-

cist. Constant vigilance is the watchword that guides to safety.

In compounding a prescription, read it carefully, closely and deliberately; procure the container of proper size, and if a bottle, fit it with a long, soft cork; procure all the implements necessary for the operation and place them within convenient reach, and proceed to compound, adding first the active constituent, and the others in their order. When the compound is finished the quantity should be checked off by the dispenser on the prescription. The numbering and labeling are next in order. The writing should be done clearly and distinctly.

Extemporaneous compounding, or as it is commonly called, the mixing of medicines, involves, besides much medical skill, the application of pharmaceutical knowledge.

In compounding liquids the most active constituent or base is diluted with the vehicle, or a portion of it, if this be in excess.

If a solid, the same general rule is applied, except that the base must invariably be reduced to a fine powder.

Substances are incompatible when they have been brought together in a mixture, either liquid or solid, with the result of undergoing a more or less complete change. This does not apply to the formation of chemical compounds. The only scientific method of determining the incompatibility of the ingredients of a mix-

ture is a correct knowledge of chemical laws and their application in pharmacy.

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## Questions on Lecture XII.

1. In what is tin principally found?
2. Are the preparations of tin poisonous?
3. Is iodide of lead deliquescent?
4. Is copper found in a native or combined state?
5. How is nitrate of silver prepared?
6. What metal is liquid at ordinary temperature?
7. From whence is the commercial supply of bismuth obtained?
8. How are liquids generally dispensed?
8. Is this endorsed by the U. S. P.?
10. What is a prescription?

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## Answers to Questions on Lecture XI.

1. Rochelle salts.
2. Below 100° to prevent explosion.
3. No.
4. No.
5. When mixed with substances of this character it explodes.
6. Yes.
7. They are often more soluble.
8. By heating the phosphate to a temperature of 300° C.
9. Rarely.
10. Iron group.

# PHARMACY.

## Lecture XIII.

PRESCRIPTIONS—*Continued.* INCOMPATIBILITY.

It often occurs that that two substances that are incompatible, as sugar of lead and sulphate of zinc, are directed to be mixed for the purpose of forming a new compound. Thus it is seen that the term incompatibility, in the generally accepted meaning, is not always clear.

There are but few cases in which the cause of incompatibility in a mixture cannot be accounted for by chemical principles, and were our knowledge sufficiently complete, these in their turn could as easily be explained by scientific methods.

Incompatibility may be distinguished as being either chemical or pharmaceutical.

Hallberg says chemical incompatibility is of the greatest importance, because the change is usually more decided between chemical compounds than between preparations of vegetable drugs, the latter involving

chiefly the solubility of their constituents, their mechanical suspension or other treatment.

Incompatibility in a chemical sense occurs when solutions of two salts are mixed and form a new insoluble salt, which precipitates, as above referred to. However, under other circumstances a similar decomposition may not be desired, as quinine sulphate and potassii acetate. In this case the acids exchange bases, and form potassium sulphate and quinine acetate. When these decompositions are intentional, the substances cannot be regarded as incompatible.

Salts of a feeble or volatile base are decomposed by the addition of a strong alkali.

Alkaloids, by the addition of alkalies or alkaline salts, are thrown out of solution, or precipitated, from solutions of their more soluble salts.

It is a general rule, that alkaloids are precipitated by alkalies.

Iron and many of its compounds produce a discoloraton or precipitation upon the addition of tannic acid and preparations containing it, gallic acid or other vegetable acids. This may be prevented by employing certain iron preparations or compounds of these with other salts, as sodium citrate.

The production of insoluble substances in mixtures of preparations of vegetable drugs, associated with or without any chemical compounds, is termed pharmaceutical incompatibility.

If such a result be the desire of the prescriber, it should not be prevented.

Pharmaceutical incompatibility most frequently occurs in liquids, and is due to a change of vehicle or solvent, causing a separation of inert or active constituents.

With solids, when different substances are acted upon when mixed, dilution often prevents undesirable changes.

In preparing ointments, pills and suppositories, care should be observed that active medicinal substances, when of such character, are each diluted with the vehicle or excipient before they are mixed together. Tannic acid is often directed to be prepared in ointment or suppository with opium or extract of belladonna, with both of which it forms an insoluble compound when brought in contact. But when each active constituent is first incorporated with a portion of the vehicle, lard or oil theobroma, no change takes place when mixed, and a smooth and active preparation is easily produced.

In the following list the substances which cannot be classed as incompatible under any of the above divisions, are given for reference:

[HALLBERG.]

| SUBSTANCE. | INCOMPATIBLE WITH— |
| --- | --- |
| *Acacia* ............... | Alcohol, alcoholic and ethereal tinctures;* Borax; Iron Chloride; Lead Salts. |

| SUBSTANCE. | INCOMPATIBLE WITH— |
|---|---|
| *Acids*, in general.. | Alkalies, Alkaline solutions; Metallic Oxides. |
| *Acid*, Arsenious... | Iron oxide; Magnesia; Lime water. |
| Salicylic...... | Iron compounds; Potassium iodide;* Lime water. |
| Tannic....... | Alkalies, Carbonates and Bicarbonates; Lime water; Chlorine water; Albumen; Gelatin. |
| *Bismuth*, Subnitrate... | Calomel; Sulphur; Tannin. |
| *Chloral* Hydrate ..... | Alkalies, Carbonates;* Ammonium and Mercury compounds. |
| *Iodine*......... ...... | Ammonia; Alkalies; Carbonates; Chloral; Metallic salts; Starch.* |
| *Lead* Acetate ...... | Acacia; Acid hydrochloric; Acid sulphuric and Sulphates; Ammon. chloride, Carbonates; Lime water; Iodine, Potass. iodide; Tannin. |
| *Mercury* Bichloride... | Potassium iodide;* Salts ; Carbonates; Tannin. |
| *Mild Chloride* Calomel...... | Acids; Acid salts; Alkalies, carbonates; Ammon. chlor,; Iodine, potass. iodide; Iron chloride, iodide; Sulphur. |
| *Potassium* Chlorate... .. | Acids, mineral; Calomel; Organic substances; Sulphur. |
| Iodide ........ | Acids, Acid salts; Alkaloids, Iron; Lead and Mercury salts; Potassium chlorate; Silver nitrate; Chlorine water. |
| Permanganate | Ammonia, salts; Alcohol; Glycerin; Ether. oils; Organic substances. |
| *Sodium* Bicarbonate. | Acids, Acid salts; Acid tannic; Alkaloids; Metal salts. |

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| SUBSTANCE. | INCOMPATIBLE WITH— |
| --- | --- |
| Bromide...... | Acids, mineral; Chlorine water; Mercury compounds. |
| *Silver* Nitrate... .... | Acids, acetic, hydrochloric, hydrocyanic, sulphuric, tartaric, and their salts; Alkalies, Carbonates; Iodine, Potass. iodide; bromides, Sulphur. |

Those marked with an * are sometimes directed to be compounded.

For further information on this subject we refer the student to "Remington's Practice of Pharmacy."

The preparations of the Pharmacopœia are divided into three classes: Solutions and Mixtures; Products by Extraction, and Mixtures of Solids.

This simple arrangement is based upon the processes involved, thus bringing preparations made by nearly the same methods under one head, in order that the subject mav be more easily comprehended and remembered. Each of these divisions were again divided into the respective classes of preparations, as the following table will illustrate.

Solutions were divided according as the solvents were water, alcohol, etc., each embracing one or more distinct pharmacopœial classes:

| | | Number of preparations officinal. |
| --- | --- | --- |
| Aqueous...... | Pure waters | 2 |
| | Chemical waters | 4 |
| | Medicated waters | 9 |
| | Infusions | 5 |
| | Decoctions | 2 |
| | Liquors | 25 |
| | Mucilages | 5 |

| | | Number of preparations officinal. |
|---|---|---|
| Alcohol | Natural Spirits | 2 |
| | Aromatic Spirits | 17 |
| | Chemical Spirits | 3 |
| Acid | Solutions of Oleates in oleic acid | 2 |
| Vinous | Natural Wines | 3 |
| | Medicated Wines | 11 |
| Saccharin | Syrup (simple) | 1 |
| | Syrups, by solution | 11 |
| | Syrup by extraction | 14 |
| | Chemical Syrups | 8 |
| Glycerites | Semi-liquid solutions in Glycerin | 2 |

Elixirs, only 1 is officinal.

Mixtures, 11 are officinal.

Liniments, 10 are officinal.

Products by extraction comprise the largest number of preparations, the most important being tinctures and fluid extracts.

Of vinegars four are officinal, each containing 10 per cent. by weight of the drug.

Tinctures are simple products of extraction, and are weaker in strength than the remaining classes.

Fluid extracts are divided into six classes, according to the process employed in their preparation :

1. Those prepared by exhausting the drug by percolation, reserving the most concentrated portion of the percolate, adding to it the remainder evaporated to suitable bulk.

2. Addition of acids to prevent change of active constituents.

3. Addition of acid in the extraction of aconite, and alkali in that of glycyrrhiza.

4. The addition of an alkali to prevent precipitation and gelatinization of senega.

5. The rejection of inert matter, so that it may mix clear with syrups, as in ipecac.

6. Exhaustion by infusion, concentration, by evaporation, and the precipitation of inert matter by the addition of alcohol.

### ABSTRACTS

are prepared by the evaporation of a fluid extract to a semi-fluid liquid and adding sugar of milk in such quantity that the weight of the mixture, when dried and powdered, equals one-half the amount of the crude drug employed.

### EXTRACTS.

are prepared by continuing the evaporation of the extractive matter until a soft solid of pilular consistency remains.

### RESINS.

By pouring the concentrated alcoholic tincture of a resinous drug into cold water, collecting and drying the precipitate.

### OLEORESINS

are obtained by extraction of drugs with ether, and evaporation of the solvent.

### MIXTURES OF SOLIDS,

owing to their compound character, are divided into

two classes, viz.: those for internal use and those for external use.

Those for internal use are arranged upon the progressive plan, commencing with the most simple form, as follows:

| | | Number of preparations officinal. |
|---|---|---|
| *Powders:* | Simple powders, opii pulvis................ | 1 |
| | Compound powders......................... | 9 |
| | Triturations..................................... | 1 |
| *Masses:* | By the incorporation of adhesive semi-liquid substances so as to obtain a plastic consistence........................ | 3 |
| *Confections:* | Masses, in which the excipient is sugar in large proportion. | |
| *Troches:* | Confections, flavored, made in various forms and dried.............................. | 15 |
| *Pills:* | Masses divided into spherical form not exceeding five grains........................ | 14 |

Preparations for external medication are all more or less oleaginous, and the vehicle employed governs their consistence; they are grouped accordingly, those most *unctuous* coming first, and then in sequence until the last class. The preparations of this last class are brittle at ordinary temperature, but when used are rendered adhesive by the warmth of the body. The following are officinal:

| | | Number of preparations officinal. |
|---|---|---|
| *Ointments:* | By simple admixture...................... | 18 |
| | By fusion.......................................... | 5 |
| | By chemical reaction..................... | 2 |

| | | Number of preparations officinal. |
|---|---|---|
| *Cerates:* | By admixture or fusion.................. | 6 |
| | By maceration and fusion...... ....... | 2 |
| *Suppositories:* | Cerates formed into cones weighing 15 grains, the vehicle being cacao oil; none officinal. | |
| *Plasters:* | Simple plasters.......... .................. | 5 |
| | Compound................................... | 12 |

Of compound plasters, lead plaster is the vehicle in seven; resin plaster in the remaining five.

### ORGANIC ACIDS.

The organic acids are compounds similar in properties and chemical structure to inorganic acids, but differing in the fact that the negative radical is complex and has a carbon nucleus.

These acids are numerous and constitute several series, each differing from the next higher in having lower fusing and vaporizing points and lower specific gravity.

### ALCOHOLS.

The alcohols form several distinct series, according as they are built on the plan of one or more water molecules. The alcohols are hydrates of more or less complex carbo-hydrogen radicals.

### ETHERS

are produced by the action of acids on alcohols, there being several distinct series. They bear the same chemical relation to alcohols that metallic oxides do to

the metallic hydrates. Some are liquid and inflammable; others dense, non-volatile and solid at ordinary temperature.

### CHLOROFORM AND CHLORAL

are compounds related to alcohols and ethers. The carbo-hydrates are composed of carbon, oxygen and hydrogen, and thus agree in chemical structure. They include starches, sugars, cellulose, lignin and gums.

### ESSENTIAL OILS

in appearance resemble the fixed oils, but differ in chemical structure. They are not saponified by alkalies. They are more or less volatile at ordinary temperature, and are completely volatilized by heat without undergoing chemical change. They are widely distributed through both the animal and vegetable kingdoms, those possessing pharmaceutical properties being chiefly derived from plants. They are obtained by expression, distillation, by aid of volatile solvents, and by the process of enfleurage.

### CAMPHORS

are solid bodies of vegetable origin, closely related to volatile oils, and in some cases derived from them.

### RESINS

are solid, usually amorphous vegetable products, soluble in alcohol, insoluble in water, usually soluble in fixed oils; generally transparent; readily fusible, and

burn with a sooty flame; not volatilized without chemical change; some unite with alkalies to form soap. They contain carbon, oxygen and hydrogen.

OLEORESINS

are mainly of vegetable origin, and are mixtures of resins and volatile oils. They are distinguished from resins by the odor given off when heated.

TURPENTINES

are oleoresins, which, with the exception of Cyprus turpentine, are derived from coniferous trees. Their volatile oils have the same chemical structure as common oil of turpentine.

BALSAMS

are liquid, semi-liquid or solid vegetable products, containing, besides resin or oleoresin, benzoic or cinnamic acid, or both.

FATTY OILS

are obtained from both the animal and vegetable kingdoms. They impart a greasy stain to paper, which does not volatilize when heat is applied. They are soluble in ether. They give off irritating vapors at a temperature of 500° or 600° F., and are not volatilized by heat without chemical change; are combustible, and unite with alkalies to form soap, with few exceptions.

EMULSIONS

are mixtures consisting of fats, oils or oleoresins in a

finely divided condition and held in suspension in a solution of gum or other substances possessing emulsifying properties.

ORGANIC DRUGS

are those obtained from the vegetable and animal kingdoms.

INOGRANIC COMPOUNDS.

Inorganic acids resemble the organic acids in the fact of being built up on the type of water molecule, with the exception of the haloid acids, and in many physical properties. Their compounds are more stable and not so complex in composition.

THE ALKALI METALS

include potassium, sodium, cæsium, lithium and ammonium.

THE ALKALI EARTHS

include magnesium, strontium, calcium and barium.

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## Questions on Lecture XIII.

1. What change takes place when quinine and acet. potassa are mixed?
2. Are alkaloids thrown out of solution by the addition of alkalies?

3. Into how many classes are the preparations of the Pharmacopœia divided?
4. How many elixirs are officinal?
5. How are oleoresins obtained?
6. To what compounds are chloroform and chloral related?
7. Are essential oils saponified by alkalies?
8. From what kingdoms are they obtained?
9. Are resins solid or liquid?
10. What are oleoresins?

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### Answers to Questions on Lecture XII.

1. Tinstone.
2. Yes.
3. No.
4. Both.
5. By treating silver with dil. nitric acid.
6. Mercury.
7. The mines at Saxony.
8. By measure.
9. No.
10. Literally, a written order.

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### Answers to Questions on Lecture XIII.

1. The acids change bases and form quinine acetate and potassium sulphate.

2. Yes.
3. Three.
4. One.
5. By extraction of drugs with ether and evaporating the solvent.
6. Alcohol and ethers.
7. No.
8. Animal and vegetable.
9. Solid.
10. They are mixtures of resins and volatile oils.

# INDEX.